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In the Back Shop and Enginehouse:

Electrical Section:

New Devices:

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Illinois Central Day Train

THE Illinois Central's new 14-car dayliner, City of New Orleans, placed in operation on April 27, inaugurates an entirely new kind of service in that the equipment is designed to make coach travel so comfortable, convenient and interesting that even a full day's journey by rail will not prove tedious. The train makes possible for the first time daylight luxury-coach service between Chicago and New Orleans on a record "dawn to dusk" schedule of 921 miles in 15 hr. 55 min., or 35 min. less than a companion overnight train, the "Panama Limited." The train also makes available equally fast service between St. Louis-New Orleans and Louisville-New Orleans. There are 19 regular intermediate stops in the run between Chicago and New Orleans.

The City of New Orleans consists of two 14-car trains which operate opposite each other daily in supplying this new service and each train will normally comprise a 6,000-hp. three-unit Electro-Motive Diesel locomotive and 14 cars, including a mail and express car, baggage-dormitory car, two 48-seat coaches, seven 56-seat coaches, a diner, diner-lounge and an observation-tavern-lounge car. The consist of the train leaving Chicago is 11 cars, one coach from St. Louis being picked up at Carbondale, Ill., and two more coaches from Louisville being picked up at Fulton, Ky., to make 14 cars going into New Orleans. The reverse operation is followed on the north-bound trip.

Coaches for the new trains were built by the Pullman-Standard Car Manufacturing Company and all other cars at the Burnside (Chicago) shops of the Illinois Central. The exterior color scheme of the train consists of an orange-brown-yellow combination which identifies all modern I. C. passenger equipment. These brilliant colors can be seen at a great distance and provide an additional safety factor in high-speed operation.

The roof and letter board to below the window line is a dark brown and, from the lower window line to the bottom of the sides, each car is finished in deep orange. The car skirts are also dark brown. Canary yellow bands run the length of the cars above and below the window line and just above the bottom of the car sides. Car names are lettered in dark brown on the deep orange field.

The Diesel locomotives which power the City of New Orleans train are the latest Type EA-7 design, built by the Electro-Motive Division of General Motors. The 6,000-hp. three-unit locomotives are geared for a top speed of 117 m.p.h.

Car Features

Maximum safety features, as prescribed by the Association of American Railroads, have been incorporated in the City of New Orleans cars. All coaches are of Pullman-Standard welded-girder-type construction with smooth sides, the structural members—underframes,

Lunch counter in the diner-lounge car

sides, ends and roofs—being made of high-strength alloy steel throughout.

This type of car has been subjected to an 800,000-lb. squeeze test by the builders to prove the safety of the design. All cars are equipped with tight lock couplers which offer increased safety by making it almost impossible for cars to uncouple accidentally. The couplers and Waughmat twin-cushion draft gears are installed on all cars, including those made both by the car builder and the railroad company.

Windows are unusually wide, 62-in. double thermopane, shatterproof glass being used in the four Day-Nite coaches. All other coaches have Adams & Westlake breather-type, double-glazed sash units, with inside glass, ¼-in. laminated plate, and outside glass, ¼-in. polished plate. All cars are thoroughly insulated with Fiberglas and Stonefelt.

Coach trucks are of the four-wheel, cast steel, all-coil-spring type, with General Steel Castings truck frames, Hyatt roller bearings and vertical shock absorbers. All cars are equipped with New York high-speed electro-pneumatic air brakes including governor and decelostat control for preventing wheel slippage. Cars are provided with air-controlled sanding equipment which is operated automatically in conjunction with the wheel-slide control. The weight of each 48-passenger Day-Nite coach is 122,475 lb.; that of each 56-passenger coach, 123,149 lb.

Coach Seating Equipment

The soft luxurious seats in the 56-capacity coaches are scientifically designed. These seats are spaced 41½ in. on centers to give ample leg room and provide a wide range of adjustment for back and foot-rest positions. A button adjusts the back of the chair to nine positions. A foot-rest located on the seat ahead is adjustable to four positions. These seats were manufactured for the new dayliner by the Coach & Car Equipment Corp.

Two of the nine coaches embody Day-Nite features, which provide the budget-minded passenger with many of the comforts and conveniences of first-class travel. Seats in these four 48-seat coaches have an extra degree of recline which enables travelers to assume a comfortable sleeping position. At night the passenger obtains a full-length sleeping surface by pulling down from the back of the seat ahead a large upholstered leg rest.

Two important improvements for sleeping comfort are incorporated in these new seats. First, they are further apart, 52 in. on centers, giving passengers an opportunity to stretch out, with their feet and legs supported at seat level instead of sleeping in a cramped position. Second, the leg support takes the pressure off the back of the knee and thus eliminates the swollen ankles that some people suffer when they sleep with their feet on the present low foot rest.

Spacious ladies' lounges with double toilet facilities are located at one end of each coach with an equally large men's lounge at the other.

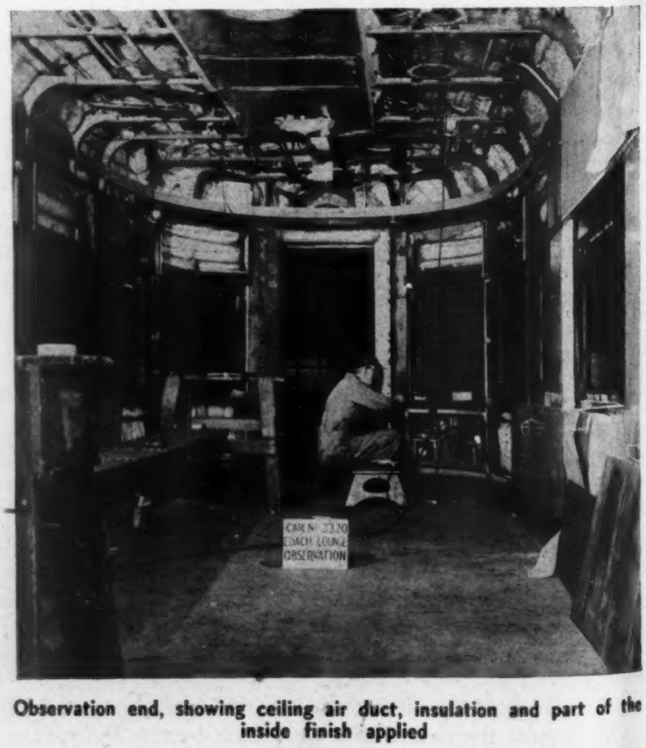
Car Lighting Facilities

In the main seating compartments of the coaches, new type lighting affords a high degree of comfort. The Safety Car Heating & Lighting Co. reading-light fixtures, installed in the overhead baggage racks, are equipped with two lenses over each cross seat, one to give light for the window passenger, the other for the aisle passenger. The light beam patterns from the reading lights are accurately designed so that each supplies a high-intensity beam at the reading plane for one passenger, without overlapping on to the adjacent passenger or others seated in the rear or forward. Each light has an individual switch so that a passenger may read without disturbing his neighbor.

To obtain maximum light in the aisles without disturbing the passengers, or causing conflicting light beams, magnifying prism-lens glass is employed in the Safety coach ceiling-light fixtures which project a narrow high-intensity beam of light the width of the aisle without extending over into the passenger area. This fixture also gives a soft, diffused light for the ceiling and upper portion of the car.

At night, when the main ceiling lights are turned out, night lights incorporated into the aisle side of the seats near the floor throw a dim light on the aisle-way. These supply a small amount of light so that passengers may move about without any difficulty, yet they are not bright enough to interfere with sleeping.

In the lavatories and toilets of the coaches, magnifying prism-lens glass lighting fixtures are also used. The



Observation end, showing ceiling air duct, insulation and part of the inside finish applied

women's dressing rooms contain large makeup mirrors with lighting fixtures on either side of the mirror. The vestibules and passageways are also lighted with individual incandescent fixtures of the magnifying prism-lens type.

Air Conditioning and Heating

All passenger cars are air-conditioned using Waukesha Model-D ice engines of eight tons' capacity and Frigidaire overhead air-conditioning units, Farr air filters and Dorex Type G-3 deodorizer panels. In general, the conditioned air is delivered to the car interiors through center ceiling air ducts and Anemostat diffusers. The latest type Vapor air-conditioning and thermostatic controls are installed. Floor heat is provided by Vapor fin-type radiation units with zone control.

Radios in the observation-tavern-lounge and the diner-lounge provide music and entertainment. A public address system is installed throughout the train and may be used to make announcements. Also, broadcasts from

Interior of a steel car shell before the insulation is applied

the master radio may be heard in all cars over the public address system.

Railroad-Built Cars

Car equipment for the City of New Orleans, other than coaches, was re-constructed at Burnside shops from a series of non-air-conditioned coaches which had sound underframes and 6-wheel trucks suitable for rebuilding to meet requirements of the new, fast service. These cars were stripped to the underframes and side sills, new posts applied where necessary, the ends rebuilt to conform to A. A. R. strength requirements, new side sheathing and round roof applied, using C. B. open-hearth steel in an all-welded construction.

The original cars averaged about 133,600 lb. in weight. The new cars weigh somewhat more, owing to added accessory equipment, but substantially less than they would have, except for the use of lightweight parts such as floor construction, insulation, inside finish including aluminum ceilings, fin-type heating units, thin-wall conduit, etc.

The mail-express car is 80½ ft. long between coupler

Side frame of one of the "City of New Orleans" railroad-built cars

pulling faces and has a 30-ft. mail compartment and a 47-ft. baggage room. In spite of considerable heavy mail-room equipment, the weight of this car was held down to 136,000 lb.

Similarly, the 80½-ft. baggage-dormitory car weighs 141,400 lb. This car contains a 25-ft. baggage section, a 6-ft. linen room and a 29½-ft. dormitory with lounge, locker and wash-room facilities for a 20-man crew. Provision is also made for a 6½-ft. steward's room and 7-ft. conductor's room, with wash and toilet equipment. The dormitory, steward's and conductor's rooms in this car are air conditioned.

The 82-ft. diner was received at the shop as an air-conditioned parlor car weighing 168,000 lb. The present weight averages 151,000 lb., owing to weight savings mentioned, plus savings in the kitchen and pantry by using Monel metal or stainless steed for cabinets, refrigerators, sinks, etc. The car includes a 17½-ft. kitchen, 9-ft. pantry, 37-ft. dining section with 36 seats, and a 5½-ft. space in one end for the steward's desk and lockers.

The kitchen ranges and hot water heaters use propane-gas fuel, as mentioned. An effective blower and ventilation system keeps the kitchen and pantry relatively cool and the passageway alongside the kitchen also is cooled by a flow of air from the air-conditioned dining compartment. The interior decorative treatment in this car is unique and attention attracting, as already suggested.

The frieze board and wainscoting are tieher mahogany or walnut veneer and the ceiling cream color. Pier panels are treated with flesh-tint mirrors. Window capping is brown and table tops, tan Formica. Ajax-Consolidated Venetian blinds are cream color and drapes, Goodall blue fabric. Safety 110-volt a.c. fluorescent light fixtures are installed along the ceiling center line and Safety 64-volt d.c. incandescent side-deck fixtures above the mirrors. Each of the veneered bulkheads is decorated with a Kaufman & Fabry full-color mural.

The diner-lounge car, weighing 148,500 lb., is 80½ ft. long and includes a 24-ft. lounge section seating 22, a 6½-ft. dining section seating 8, a 19-ft. lunch-counter

(Continued on page 352)

A More Effective

Mechanical Department

The six prize-winning papers and the nine receiving honorable mention in the competition "How Can We Step Up Mechanical Department Effectiveness" were published in the June issue of the *Railway Mechanical Engineer*. Still other contributions of merit were received as a result of the competition. Three of these—one discussing the problems of supervision, a second dealing with the car question, and a third covering one phase of locomotive design and maintenance—are published below.

Train and Encourage Your Supervisors

Afford them an opportunity to improve themselves and when they do it management should show appreciation

By G. H. Raner
Illinois Central, Chicago

The first need is for the officers and others in charge fully to realize that one of the heaviest obligations which rests upon them is the selection and proper training of supervisors.

The very secret which lies behind the formation or creation of a successful and smooth operating organization is to be found in the proper selection of men for supervisory positions, and then training them. The word "training" does not fully signify the broad scope and extent to which aid should be given, and made available to supervision. It should be a continuous process. A supervisor needs that constant stimulation which keeps alive the spark of encouragement, and which comes from well rounded, practical training, and guidance.

It must be realized that he needs to have a knowledge of a great many things about which he knew little before he became a supervisor. It must also be realized by himself and the officers in charge that, when he becomes a supervisor, he is entering an entirely new field of endeavor, and one which requires a different kind of training to that which he received as a journeyman.

With effective recognition by supervisors and railroad management of the necessity of doing something about it, then the ways and means of setting in motion an adequate plan and procedure will, I believe, follow, and one that will serve to equip and strengthen the hands of supervisors to enable them to function with a greater degree of effectiveness.

Top officers must first be sold on the need for such training and on the plan to pursue. This feeling should go down through the ranks of those in supervisory positions.

In the selection of materials to form the basis of a training program, certain fundamental features must be observed. First, it should be with as little theory as possible, but should contain as much practical material as is possible, and this, together with the manner in which the program is conducted, should be such that the supervisor will want this training. It should be a program that would attract through the gainful purpose that it would serve and to the extent that it would stand on its own merits. I will later discuss in some detail such a program.

The term "supervisor" as used here is not to be regarded as a title of a particular job but rather a descriptive term of all positions supervisory in nature in the mechanical department, regardless of job title. I refer in particular to the front line supervisor, that man who is out directing the activities of those actually doing the job of work, because he in my opinion is the one who needs help most.

There is a great deal to be said and to be done in the matter of selecting men for supervisors, because too often in the past (and perhaps now) men were placed on supervisory jobs with few instructions, other than to be told to "go to it; we'll see what you can do." If he succeeded in carrying out his supervisory assignment with such limited instructions, he would have to possess unusual talents and somewhat of a native ability and aptitude to cope with supervisory problems.

On the other hand, if not successful and he is set back to his former status, two evils will result. Others will become discouraged in accepting promotion; the demoted man will not always return to his former status with the satisfaction and loyalty to the company he perhaps possessed before his promotion. Both affect the general state of morale in the plant.

Supervisors Need Help, Too

It is more important to give help through training and counsel to those already on supervisory jobs, and with an adequate program for them, the matter of proper selection of supervisors will correct its evils through this program, for, such a program should touch heavily on that feature.

There are two fundamental means by which the supervisor can become better equipped and strengthened, and which will enable him to function more effectively.

One is to afford an opportunity through the medium of an adequate program of training whereby the supervisor through his own efforts may improve himself.

The second one is the help and encouragement that must come whole-heartedly from railway management. Inspiration from this source will result in a degree of initiative which as time and occasion demand will become more effective.

A number of subjects which should be incorporated in a program of training and self improvement in supervision are enumerated here and briefly discussed: Management of one's self; understanding people; the importance of perspective: What morale really is, how it works, and causes of the various degrees of morale, the sources of morale. In the matter of perspective, there cannot be clear thinking or clear vision when supervisors are burdened with details to the extent that it detracts from overall perspective. Desirable and undesirable qualities of a supervisor are other subjects. The various qualities of good leadership which include, control of self, proper attitude, thoroughness and reliability, perseverance and follow-through, ability to think, fairness in dealings, development of leadership qualities.

There are sources from which such basic material may be obtained. Some outside agencies or corporations are in a position to furnish material and assistance from which a practical, effective, and far reaching program could be developed.

Many of the company's instruction pamphlets rules, policies, safety rules, working agreements, could be made a part of the program. This should result in a clear and uniform understanding of them.

Interspersed in the program, members of other departments should be invited to explain the functions of that department in order to give the supervisor some idea of just how he fits into the picture as a whole. He should know something of the workings of the personnel department, the purchases and stores, accounting, etc.

There are available sound films illustrating good and bad methods in supervision which could add to the program.

From experience I favor the conference method as the most effective method of supervisory training, because what many supervisors refer to as a school room atmosphere is not present.

Each supervisor is afforded an equal opportunity freely to discuss the subject across the table with his fellow supervisors. Through such discussions he is given an excellent opportunity to judge the soundness of his own ideas. It helps him become more open-minded to new ideas and methods. It gives him an opportunity to see that other supervisors also have problems. He comes to know about them and it places him in a position to guide his own actions so that they may not create problems for other supervisors. He should, through such conferences, acquire the habit of thinking before speaking and acting. He is afforded the opportunity to learn, to express himself more capably and convincingly.

This plan further provides him with an opportunity to see more clearly his own problems and to match them against a different background than his own experience can provide. The way is granted here by which others may stimulate and inspire his thoughts. Their viewpoint is broadened; they should come to understand that accomplishment rests on cooperation. Such a process and plan will aid in revising and bringing up to date the formula for getting people who work for you to do the things you want them to do.

Such a program I have briefly described, could in my opinion, best be headed up under the guidance of one of the railroad officers who would direct and assist in carrying it out, but without too much interference or direction.

The various groups of supervisors, numbering from 10 to 15, should conduct discussions under the guidance of a leader, preferably a local, well-known and respected supervisor.

I have heard it said by older supervisors that "Unfortunately such a training program was 30 years too late for him; that if he had been given such an opportunity when he was made a supervisor, he would have avoided many hard knocks and pitfalls."

I know of those who have acquired broader vision, and with it, finer personalities and greater capabilities.

To guide one's actions, it is said, we must guide his thinking, and to guide his thinking, we must have some means of co-ordination. To recognize a situation about which something should be done, and then do nothing about it, it is just as well that it had not been recognized in the first place.

High Spots of the Car Department Problem

Some reasons for the shortage of manpower—Car shortages—The remedy, more cars—Other helpful measures

By John T. Ford

Clerk, Car Department, New York Central, Toledo, Ohio

The car department's postwar problem is one of many complexities. The following deals with what I believe to be its most important aspects.

Man Shortage

The rate of pay does not attract young men to the car department. In other industries the man can earn as much in most cases working five days a week as he can in six days in railroad work. Even in the case of piece work, the majority of young men take work in other industries as they do not feel the extra effort working piece work is warranted, considering other advantages in industry. A solution? Higher wages.

Working conditions do not compare with other industries from the health standpoint. The railroad never was considered a bed of roses, but an outside repair track where men must battle the elements to repair cars is a definite detraction. In closed shops where heavy repairs are done this condition does not prevail. All railroads do not follow the same pattern in any respect, some having fair working conditions even on light repair tracks, such as concrete runs between rails and adjacent tracks, shelters placed conveniently, adequate drainage for rain and snow, etc. Improvements of these conditions are in order.

The car-department apprentice program is very sketchy. On some roads it is good, on others there is no program at all. This is due to low wages at the bottom and not too much promise at the completion of apprenticeship.

To Make the Best of It

These disadvantages could be overcome by a suitable form of advertising, probably in pamphlet form, placed in all employment agencies, private, state, federal etc., explaining the good points such as the railroad retirement program—considered tops in social legislation—free transportation, etc. If the army can recruit at low rates of pay, the railroads should be able to, regardless of the patriotic aspect involved in the comparison. More co-operation between management and unions is also indicated here with sufficient elasticity in working rules to allow promotion without conflict. The complexity of present day railroad working rules discourages new employees at the outset.

Car Shortage

While there is a freight car shortage, the bad order cars are on the increase due primarily to the age of the equipment being operated, which is aggravated by an ever increasing demand for equipment and insufficient new cars in the course of construction to allow a suitable retirement program. More new cars must be built to allow demolition of these old cars which are causing high freight claims. The railroads are still hampered with a material shortage and this subject should receive government action, possibly restoring a priority to the roads.

Until this is done there are other things that will assist in reducing cripples, such as closer inspection at terminals and intermediate points and at the time of loading if possible. The application of small things without setting out the car for major work, such as cotter keys, etc., are a great help in keeping the car in operation and preventing a bad-order set out en route. This feature should be placed squarely on the shoulders of supervision to campaign among inspection forces. Closer adherence to A. R. R. shopping requirements on air-brake and repacking programs, regardless of whether the car is loaded or empty.

Help From Car Service

The car shortage is also tied in with other conditions pertinent to the car service department, which functions under severe handicaps at present. If car service departments could bring about a better supply of freight cars this would allow more cars to be removed from the grind of continuous service and either shopped or retired. Demurrage rates should be increased against those handling cars to stimulate a more prompt unloading. The five-day week enjoyed by industry accounts for a goodly percentage of lost car days. Where there is a five-day week involved demurrage should be charged for every day after the allotted tariff-free time, whether it be Saturday, Sunday, holiday or work day. The railroad must work seven days a week to keep cars moving and it is most unfair for industry to be allowed to take advantage of demurrage rules to keep from paying overtime rates to get the cars unloaded over week-ends. The roads are, and always were, too lenient in this respect, possibly due to a threat of business diversion, but if all roads were uniform in this respect any loss would be neutralized and I believe a gain in revenue would be shown through the increased number of cars restored to service. Trucks must be unloaded while the driver waits, why not the freight car? The higher demurrage would take the place of the driver. Loss of business to trucking concerns would also be overcome by increased car revenue.

Broader Aspects

The solution to car department's problems cannot be summarized by dealing with the particular ills of that department. The car department is dependent on all other departments for suitable operation and it therefore is obvious that the entire structure of the railroad must be examined to bring about anything greater than small improvements such as new tools, etc. For instance, the car department does not make bad-order cars, but they are held accountable for them while in their possession.

The lack of operating funds is probably behind the neglect of facilities, new car building, etc., and it would therefore behoove the government to determine if this is fact, and if so to render aid either through adequate freight rates, through revision of taxes, etc. However, in my opinion, if such aid is solicited and received from government to improve railway operation in its entirety, the government should have the right to supervise and make sure where the revenue is going. This is to protect the tax payer.

The Inaccessibility of Parts

Some definite examples of the hard-to-get-at jobs in the enginehouse and back shop —A plan for eliminating them suggested

By H. V. Banks

General foreman, Cammas Prarie Railroad Company, Lewiston, Idaho.

By a determined attack on the "inaccessibility" of items needing repairs, I believe that we can step up mechanical department effectiveness. The problem of outstanding importance with respect to the maintenance and utilization of locomotives is the time element used in making repairs and testing, together with the vital necessity of cutting down on failures and repeater jobs.

All enginehouse supervisors know that sufficient time to properly care for maintenance is not always available, and that every layover minute can not always be utilized for this purpose due to many reasons, but chiefly lack of time for the particular job. So any plan that would help utilize this dead time through being able to do jobs quicker, and surely less frequently, would help solve the main problem as well as saving a large system many thousands of dollars a year in lost time going after special tools and tearing down unnecessarily to get at jobs.

Bearing in mind the old adage of "no criticism unless having a remedy to offer" the following plan is submitted.

Appoint a competent man or two of a diplomatic nature

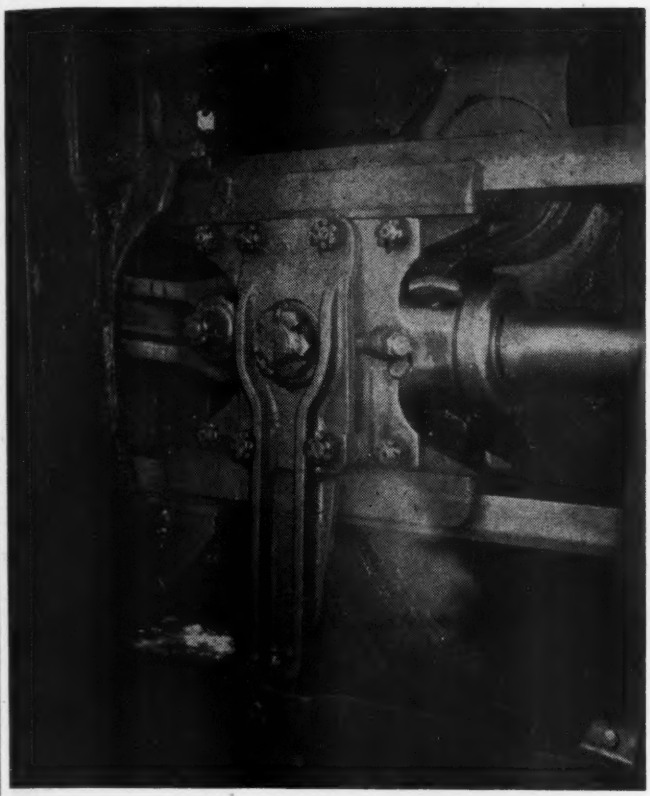


Fig. 1—The wrist pin nut is between two ribs that interfere with the use of a box wrench

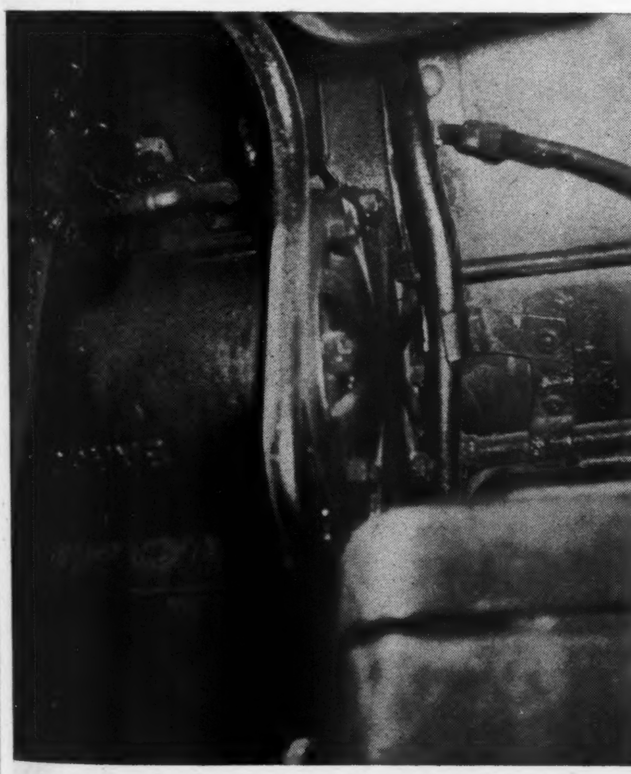


Fig. 2—The air reverse interferes with the valve chest

to tour the enginehouses and back shops contacting the foremen and mechanics to find out what jobs are the headaches and repeaters. These "research" men should sift all ideas and suggestions for simplifying the equipment. Those found worthy of study can be submitted to the chief mechanical officer for approval and subsequent back shop or roundhouse programming. The research men should be empowered to inspect locomotives, looking for such jobs as described later and making suggestions on small items for the purpose of inculcating in the mechanics when putting up new jobs the vital necessity of future accessibility. Their job would include selling the foreman on the program by convincing him of the advantages. These are simpler, faster work, less failures from inaccessable devices poorly tightened and the elimination of hammer and chisel jobs and many "special tools" which cost his organization plenty of time to make, plenty of time going after and returning them, and no doubt many personal injuries from their use. The back shop or erecting house foreman gains also in the long run as a little thought will disclose, though not to such a striking degree as the roundhouse man but the gain is very much worth his interest also, once the plan is working, and their mutual cooperation is essential to its success.

The accompanying snapshots are a random few of the numerous examples available as concrete illustrations of "hard to get at jobs" that could easily be simplified. They are not confined to any one railroad but seem to be present on all of them, possibly due to lack of understanding of the maintenance man's problems. I am convinced from my personal experience on several different railroads during the past 35 years that the problem is growing more acute with the advent of so many auxiliary devices, especially those later "added" to the older locomotives.

In Fig. 1 note that the wrist pin nut is between two ribs where the usual efficient box wrench is useless. An oversize barrel wrench or socket wrench has to be made up and added to the tool pile. Remedy—the wrist pin thread extension could have been made longer by adding a heavy ring or collar instead of the usual ⅜-in. collar which would bring the nut out where a standard box wrench would do a proper job of tightening and would in no way interfere or foul operation.

Fig. 2 shows the air reverse was set in so close to the boiler that the valve chest is imbedded in the jacket, necessitating cutting loose and moving out the whole device in order to raise chest off for repairs. Also note that the

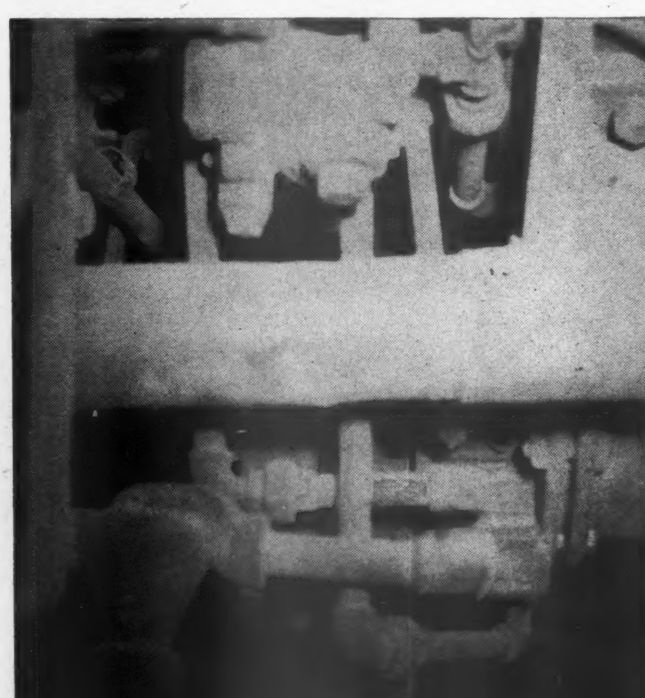


Fig. 3—Changing this triple valve would be easy if the pipe work were better

Fig. 4—Special wrenches are needed to remove this distributing valve

Fig. 5—Poor pipe work invites hammer and chisel work

sand pipe fouls the cylinder head, requiring its removal before the cylinder head can be removed. Nothing prevents this and future applications being moved out two or three inches which would simplify tremendously the chest renewal or repair, and make packing-cup renewal easier by leaving room for the sand pipe behind the cylinder.

Fig. 3 shows a pipe job which makes removal of an L.N. triple anything but the easy job it should be. The remedy is obvious.

In Fig. 4 a distributing valve is shown "pocketed" so that special wrenches must be made up to remove it. There is ample room on this class of locomotive to hang a divided reservoir at right angles so the valve and piping would not foul each other.

A simple pipe problem is shown in Fig. 5 and while it in itself is not bad, pipe work is often the chief offender in thoughtless blocking of easy access to some device and numerous instances are to be found where it is true so one or two concrete examples should suffice as illustrations. In this example the "birds nest" of pipe invites hammer and chisel work, short tempers and burns trying to get at the valves. The remedy is quite obvious.

Fig. 6 shows two horizontally placed brake cylinders behind the cylinder saddle. They are hard to get at and so covered with grease that 20 to 30 minutes are lost getting up courage enough to crawl into them, let alone mention the time lost due to inaccessibility. This is typical of early designs where the location of the brake cylinders seemed an afterthought. Setting them upright and low enough is feasible and on the newer engines justified. Also steam cleaning before repairing helps morale and speeds up the work.

The triple valve shown in Fig. 7 is so close to the reservoir that a simple job is made troublesome. A longer nipple with a proper crowfoot would easily fix it.

Fig. 6—These brake cylinders are hard to get at and so covered with grease that about one half hour is lost in getting up courage enough to crawl in and work on them

Fig. 7—The triple valve is so close to the reservoir that a simple job is made troublesome

Before closing this paper, I wish to say that it was submitted with the idea of constructive criticism only and with sincere apologies to the many splendid supervisors of the past and present who have been so burdened with petty details that they had little if any time to personally supervise the individual jobs.

Testing Wrought Steel Wheels

By Reid L. Kenyon*

Increasing severity of service requires testing under service conditions—Laboratory methods reveal conditions surrounding failures

STATIC loading tests have always shown wrought steel wheels to have a considerable margin of strength to resist rupture. For many years, operating conditions were not severe enough to raise any question as to whether the wheels had adequate strength, yet the increasing severity of service, partly because of faster train schedules and quicker stops, has emphasized the need for some means of testing that would indicate the expected performance of wheels in service.

The percentage of wheels that fail in service is extremely small but each failure by rupture is a potential cause of derailment. A thorough study of the causes of such failures was therefore initiated several years ago.

Examination of wheels in service showed that thermal cracks were the principal cause of failures, such as the one shown in Fig. 1. This wheel, which was worn to a fairly thin rim in service, had thermal cracks on the fractures. Microscopic examination of many thermal cracked wheels revealed a heat-affected zone of martensite or its transformation products under the tread in almost every case. Such changes in structure require heating of the steel to 1,350 deg. F. or higher, followed by rapid cooling. This intense surface heating by the brake shoes and the subsequent cooling builds up internal stresses that lead to the formation of thermal cracks.

Fig. 1—Wheel failure in service—Typical behavior due to combination of deep thermal cracks in the rim and stresses built-up in the plate by excessive brake action

Severe braking not only produces thermal cracks but may induce such high radial compression stresses[1] in the plate that a sudden weakening of the rim by a rapidly growing thermal crack may result in failure as illustrated in Fig. 1.

The method of testing to be described is based on this fundamental concept which was explained in some detail in a previous paper.[2]

Development of Testing Equipment

When we first formulated this stress theory of thermal cracking and plate failure of wheels and developed the technique of measuring stresses in wheels by the "rosette method," there were no facilities available for testing full-sized car wheels under conditions that approximated the severity of railroad service. Large-scale tests in actual service were dismissed because of the many uncontrollable variables, the length of time required to obtain results, and the safety hazard of testing untried experimental wheels in high-speed service.

As a first step in developing a laboratory test for wheels, we used the A.A.R. brake-shoe testing machine at Purdue University. Despite the limitation of power and speed of this machine, and the fact that it applies only a single brake shoe to the wheel, much useful information was obtained from these tests.

The maximum safe operating speed of the Purdue

Fig. 2—Wheel which failed after thermal cracking and drag testing on Armco wheel testing machine

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1 These can be measured by the "rosette" method described by Reid L. Kenyon and Harry Tobin in an article entitled Stresses in Car Wheels published in *Railway Mechanical Engineer*, Dec. 1941 and Jan. 1942.

2 See article entitled Thermal Stresses in Wrought Steel Wheels by R. L. Kenyon in *Railway Mechanical Engineer*, Aug. 1946.

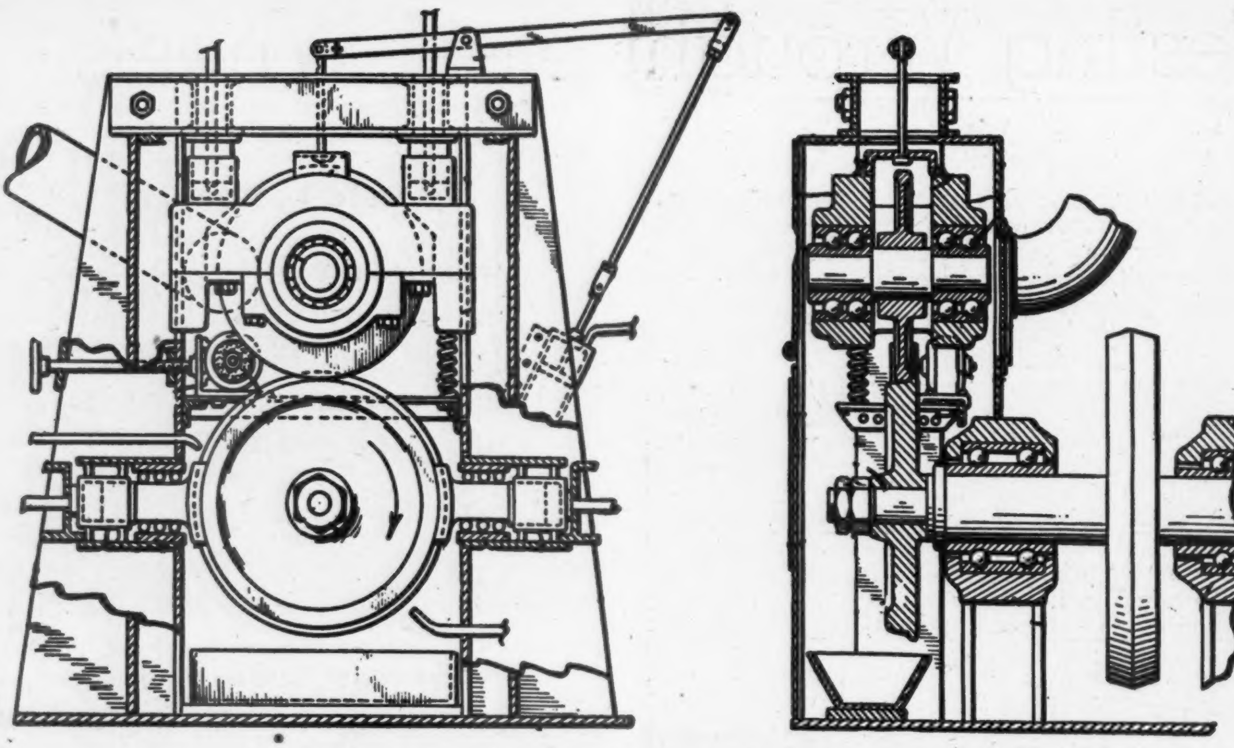


Fig. 3—General arrangement of the Armco wheel testing machine

machine was 100 m.p.h. and the greatest brake-shoe pressure that could be applied on the single brake shoe was 20,000 lb. There was not enough power for dragging-brake tests. Even with these limitations it was possible to develop thermal cracks in the wheel treads and introduce measurable stresses in the rim and plate of the wheels. Extensive tests were conducted on this machine over a three-year period beginning in January 1936. These tests indicated the advantages that would be gained by using a machine especially designed to simulate more closely the actual conditions of service. Armco engineers designed a special wheel testing machine,[3] which was constructed in the Wheel Works of The American Rolling Mill Company at its plant in Butler, Pa.

Fig. 4—Front view of Armco wheel testing machine showing test wheel in place (lower) with "Rail Wheel" (above) blocked up from contact with the test wheel

This machine resembles the one at Purdue in that it has a large flywheel to provide inertia proportional to that which would be imposed on a single wheel under a loaded car. It differs, however, in most other respects. A large electric motor provides sufficient power to drive the wheel at speeds up to 150 m.p.h. Two brake-shoe holders placed 180 deg. apart are actuated by hydraulic pressure regulated by an accumulator for accurate control. This pressure can be built up to 50,000 lb. per brake shoe if desired. By means of an interchangeable gear reducer it is possible to make dragging-brake tests under heavy pressure for long periods at speeds up to 60 m.p.h., thus simulating the descent of trains on heavy mountain grades.

These features, as well as adequate safety devices, automatic control, and recording instruments, make it possible to subject the wheel to conditions even more severe than those encountered in present-day service. This is necessary to accelerate the tests and to develop wheels to meet even more severe service conditions. The Armco machine is also designed to simulate rail contact with the test wheel. Wheel loads up to 100,000 lb. can be applied hydraulically and controlled by an accumulator. This feature provides a means of studying the resistance of wheels to shelling of the tread metal (fatigue failure of the tread metal due to high contact load with the rail).

The general arrangement of the machine is shown in the schematic diagram of Fig. 3. A front view with the doors open is seen in Fig. 4. The essential specifications are given in Table I.

[3] U. S. Patent No. 2,293,344.

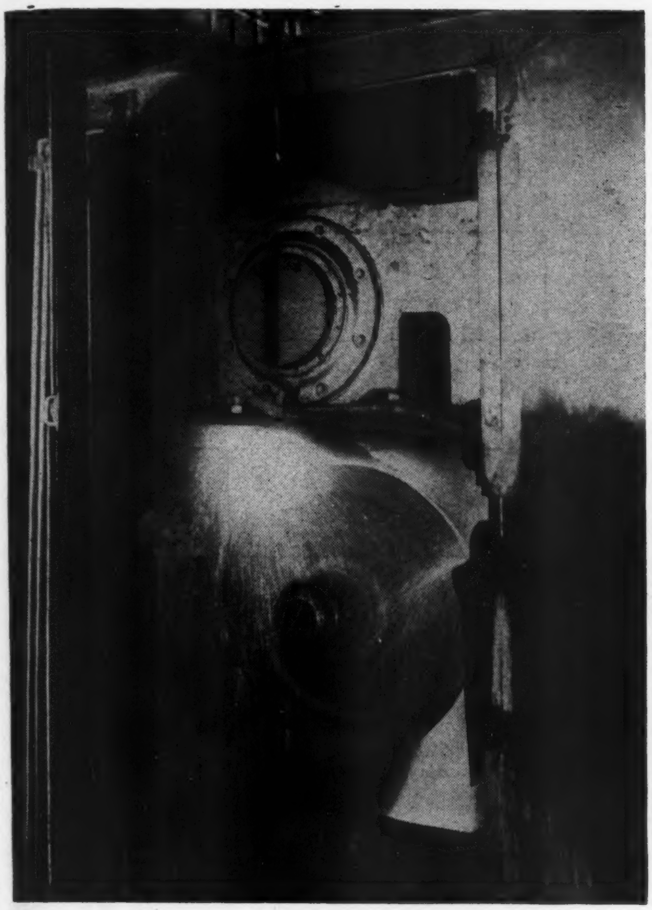


Fig. 5—Heavy "stop" brake application from 130 m.p.h. with 20,000 lb. pressure on each brake shoe

Development of Testing Methods

One of the principal difficulties encountered in the work at Purdue was the building up of welded brake shoe metal on the wheel tread. This resulted from the high temperature developed by the brake shoes under 20,000 lb. pressure at speeds at 100 m.p.h. or higher. Under these conditions heat is generated at a rate of about 225,000 ft.-lb. per sec. or 17,000 B.t.u. per min. Fig 5 gives an idea of the severity of such an application on the Armco machine.

The Armco machine was designed to permit grinding

Table I—Specifications of Armco Wheel Testing Machine

Sizes of wheels accommodated, in.	24 to 42
Maximum speed, r.p.m.	1,500
(Equivalent to 117 m.p.h. on 24 in.; 160 m.p.h. on 36 in.; 188 m.p.h. on 42 in. diam. wheels)	
Flywheel energy	6,830,000 ft. lb. at 1,500 r.p.m. 4,510,000 ft. lb. at 1,220 r.p.m. 2,630,000 ft. lb. at 934 r.p.m. (100 m.p.h. on 36 in. wheel)
Motor—variable speed d.c.	500 to 1,500 r.p.m. 75 to 100 hp. 280 to 360 amp. 250 volts
Gear ratio of speed reducer for drag testing	3 to 1
Brake shoes (either tread or flange Std. A.A.R. Shoes)	2
Pressure per shoe	50,000 lb. max.
Wheel load	100,000 lb. max.
Rail wheel	36 in. diam.
Contour radius	24 in.

either the tread of the test wheel or the contour of the "rail wheel." Grinding of the test wheel was objectionable because it was difficult to remove the brake metal without grinding away the martensitic layer developed on the wheel tread by the brake action. Considerable effort was expended in developing a cycle of brake applications that would cause thermal cracks to grow entirely across the wheel tread without building up thick patches of brake-shoe metal.

Brake applications were made at speeds up to 130 m.p.h. with pressures from 2,000 to 40,000 lb. per shoe for various lengths of time, with different rail wheel pressures against the test wheel. Braking conditions that avoided welded brake metal on the tread of the test wheel produced innumerable small thermal cracks but they grew at a slow rate. At first, cracks could be made to grow across the tread only with accompanying build-up of brake metal. The rail wheel was used to knock this off and minimize its accumulation, but it seemed to cool the contact area on the test wheel. It decreased the amount of welded brake metal but its use in the thermal cracking cycle was discontinued.

After many trials it was found that most of the brake metal that was welded to the tread by a few heavy applications could be removed by several lighter applications. The cycle finally adopted was ten light applications followed by five heavy applications. The wheel was cooled by flooding the tread with water for four min., beginning as soon as the brakes were released. The applications are described in Table II.

The change from light to heavy applications is easily accomplished by cross connections in the piping from the

Table II—Wheel Testing Cycles

Designation	Purpose	Pressure per Shoe[4]	Speed mph.	Time of Appl.	Time of Water Cooling
Light application	Clean tread	3,500	100	1,400 rev.	4 min.
Heavy application	Produce thermal crack	20,000	130[5]	About 15 sec.[6]	4 min.
Light drag	Produce crack growth	3,500	60	5 min.[7]	4-6 min.
Long light drag	Build up stresses	3,500	60	30 min.[7]	15-20 min.

[4] Two shoes used in all tests.
[5] 1,220 r.p.m. equivalent to 130 m.p.h. on 36 in diam. wheels or 120 m.p.h. on 33 in. diam. wheel. This speed gives 4,500,000 ft. lb. energy in flywheel.
[6] Brakes released when slowed down to about 20 m.p.h.
[7] Brakes are on 50 sec. and off 10 sec. each minute.

two hydraulic accumulators so that either one can be applied to the brake system (when the rail wheel is not being used). One is loaded the proper amount to apply 20,000 lb. and the other 3,500 lb. pressure on the brake-shoe cylinders. By the use of hydraulic valves in each accumulated pipe line, two different pressures are available at will.

The ten-light five-heavy cycle has been adopted as

Fig. 6—Wheel failure on Armco wheel testing machine—Typical behavior due to heavy brake applications on a wheel with a thermal cracked rim

standard for testing for thermal cracking resistance and is repeated until a thermal crack becomes one inch long. This is an arbitrary length chosen for purposes of comparison of various wheels.

Measurements made during the course of a test revealed an increase in the magnitude of the stresses in the plate or web of the wheel. These were high in radial compression, which caused considerable worry due to the possibility that a thermal crack might suddenly grow through the rim during a test and cause rupture of the wheel.

A near accident taught us a valuable lesson. A highly stressed wheel that had received many applications was insufficiently cooled after a heavy application. The cooling water was turned off and the wheel accelerated for

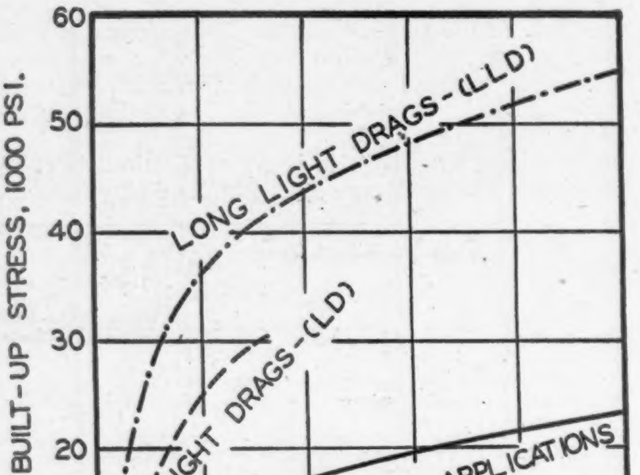


Fig. 7—Stress build-up in wheels by various types of brake applications on testing machine

the next application. A thermal crack progressed instantaneously through the rim and around the plate as shown in Fig. 6. The crack in the rim opened up ¾-in. showing the effect of high tangential tension stresses. When the edge of the crack struck the brake-shoe holder the wheel stopped; but the machine was rugged enough to stand the impact and no damage was done. The wheel was warm and apparently was still cooling down due to evaporation and windage as it was being accelerated. This probably lowered the temperature and the stresses were increased enough by this further contraction to result in rupture.

After this experience the wheel has always been cooled, at least to room temperature, before accelerating for the next application. Several hundred wheels have been tested and there have been no exceptions to the rule that "failure *always* occurs during cooling and never during heating".

Although the thermal cracking test was an important means of evaluating wheels it represented only one kind of service conditions. Wheels are often subjected to long steady brake applications as on mountain grades. Medium

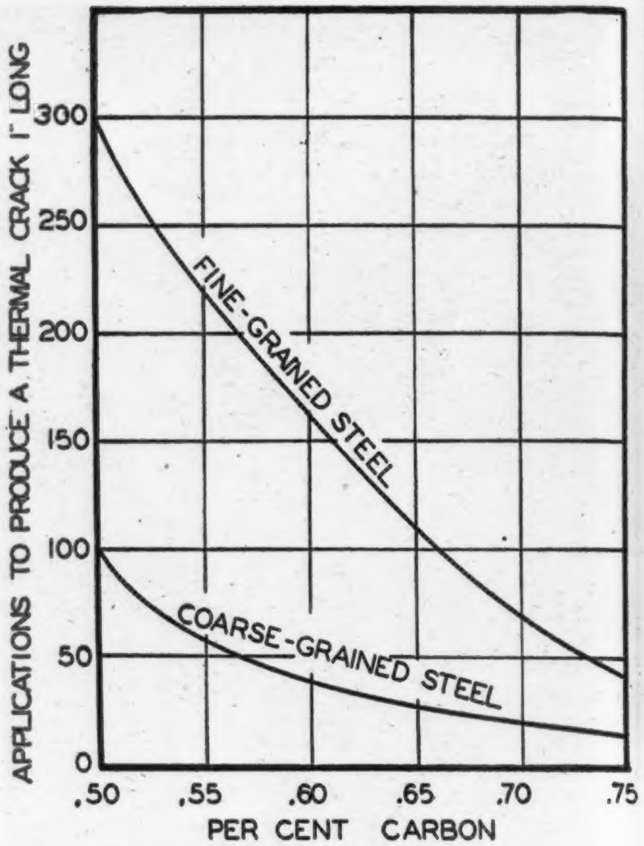


Fig. 8—Variation in thermal cracking resistance with carbon content of fine-grained and coarse-grained wrought-steel wheels as determined by brake application on the wheel testing machine

pressures are often used to reduce speed. This is generally considered less severe than stop applications, but it was necessary to study the effect on the testing machine.

As with the development of the thermal cracking cycle many different combinations of brake pressure, speed, and time of application were tried in working out a suitable dragging-brake cycle. One of the main problems was to regulate the severity so as to get the most heat penetration into the rim without wearing away the shoes too rapidly or causing undue welding of brake metal on the tread. Two different cycles were developed: a light drag and a long light drag test. Details are given in Table II.

It was found that stresses built up faster in the wheel with dragging brake than with thermal cracking applications. This is doubtless due to the difference in the amount of heat developed and the longer time for it to penetrate throughout the entire rim in the case of the

(*Continued on page 353*)

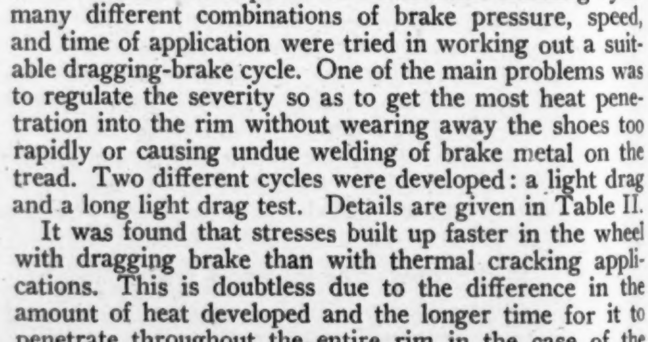


Fig. 9—Rate of growth of thermal cracks as related to carbon content of wrought steel wheels

Timken Roller Bearings on

Union Pacific Stock Cars

THE 300 Union Pacific stock cars, scheduled to be thoroughly reconditioned and equipped with Timken roller bearings for high-speed service, as announced in an equipment news item in the May *Railway Mechanical Engineer,* will be painted the familiar U. P. streamliner colors of canary yellow with bright red lettering and used in fast, non-stop Diesel-operated freight service between Salt Lake City, Utah, and Los Angeles, Calif.

A conventional freight-car truck equipped with Timken roller bearings

This new manifest stock service will reduce the westbound schedule more than 40 per cent by eliminating a stopover at Las Vegas, Nev., for water and feed. With this service in effect, the Union Pacific will be in a position to transport livestock, nonstop from Salt Lake City to Los Angeles in about 32 hr. instead of the usual schedule of 58 to 60 hr. In other words, practically passenger-train schedules will be provided for the delivery of livestock.

The higher freight train speeds will be made possible largely by the use of roller bearings which eliminate speed restrictions, as far as journal bearings are concerned, and also practically eliminate the possibility of hot boxes and other journal troubles. In addition, the roller bearings will reduce starting resistance about 90 per cent.

Work Done on the Cars

The 300 stock cars to which roller bearings are to be applied are 40-ft. cars, having an inside length of 40 ft. 6 in., inside width of 8 ft. 10 in. and inside height at eaves of 9 ft. 4¼ in. These cars were converted from box cars in 1938, have steel underframes, steel ends and steel roofs, and are equipped with AB brakes and power hand brakes.

The cars are now being conditioned for high-speed service by making necessary repairs to the underframes, replacing defective side slats, and applying all-steel riveted roofs to such cars as were not equipped previously.

Of these cars, 250 will be double-deck with the upper deck located 5 ft. 4 in. from the floor. This will permit handling either single-deck loads of cattle on the lower deck, or the double-deck loading of sheep or hogs. Fifty cars will be single deck.

In addition to finishing the car sides in Armour yellow with red lettering the color scheme calls for ends and roofs painted aluminum. The aluminum-painted roofs are expected to reflect the sun's rays to a certain extent and thus reduce the heating effect on stock being shipped.

These cars are equipped with 5½-in. by 10-in. journals and trucks having springs arranged for 80,000-lb. load, with a load limit of 90,000 lb. Upon receipt of roller bearings, the trucks will be conditioned, new bearings applied and conventional spring snubbers conditioned or replaced as necessary.

The double-deck cars weigh approximately 45,800 lb. and the single-deck cars average about 45,000 lb.

Roller Bearing Application

The Timken roller bearings used in these stock cars are included in enclosures of special design, as shown in the illustrations. In order to utilize existing side frames, with the original friction-bearing journal boxes cast integral, a slight modification of the side frame is necessary. This consists simply of removing the dust-guard retaining webs at the back end of the friction-bearing box.

Two single-row Timken bearings are used in a roller-bearing enclosure, the top of which is designed to simulate the wedge of the friction bearing. The Timken bearing enclosure has recesses cast on the sides, corresponding to side-thrust lugs on the inside of a friction-bearing box, in order to take transverse loads and hold the wheels in proper relation to the truck frames.

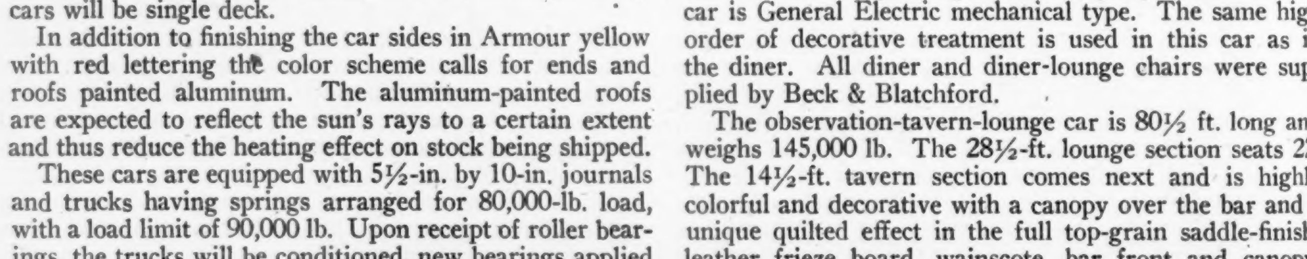
The U. P. has three car sets of these roller bearings applied at present and delivery of the 300 car sets of bearings and boxes is expected to start this month.

I. C. Day Train

(*Continued from page 341*)

section seating 10, a 16-ft. kitchen and a 6½-ft. stewardess' compartment, fully equipped. The range and steam-tables in this car also are propane-gas operated. All kitchen refrigerating and cooling equipment in this car is General Electric mechanical type. The same high order of decorative treatment is used in this car as in the diner. All diner and diner-lounge chairs were supplied by Beck & Blatchford.

The observation-tavern-lounge car is 80½ ft. long and weighs 145,000 lb. The 28½-ft. lounge section seats 27. The 14½-ft. tavern section comes next and is highly colorful and decorative with a canopy over the bar and a unique quilted effect in the full top-grain saddle-finish-leather frieze board, wainscote, bar front and canopy. K. & F. blue-tone murals add greatly to the interest in this part of the car.



Timken roller-bearing enclosure applied to a journal (left) and inserted in the conventional journal box (right)

The observation section is 29 ft. long and seats 21. The decorative treatment features a light yellow ceiling, Hardwood veneer frieze board and wainscoting, light blue pier panel, pearlescent Formica window capping and table tops, blue draperies and Venetian blinds, Goodall red fabric seat covering, blue floor carpet and General Fireproofing chairs and settees. General illumination is supplied by a continuous fluorescent ceiling trough, the same as in the lounge and tavern sections. The decorative and color treatment in this and all other cars of the City of New Orleans was developed by the Pullman-Standard color and design department.

Electric power for lighting and other purposes, exclusive of air-conditioning, is supplied by Safety 10-kw. body-hung generators with Spicer mechanical drive from the truck wheels. Safety motor alternators take 64-volt a.c. power and delivers it as 120 volt a.c. for use in the fluorescent lights. Car batteries are of the Exide-Ironclad type.

Six-Wheel Trucks Rebuilt

Six-wheel trucks for railroad-built cars of the new train are of the double-bolster type, with bottom equalizers, elliptic bolster springs and coil equalizer springs. They were equipped originally with friction-type bearings and with American-type clasp brakes. The brake cylinder was body hung and the brake rigging was designed for conventional braking of 90 per cent in full service and 112 per cent in emergency.

For service in the City of New Orleans, Timken roller bearings were applied to special 5½-in. by 10-in. axles having the same journal centers as the original 5-in. by 9-in. axles. The American clasp brakes were brought up-to-date by adding the A. S. F. Simplex unit-cylinder feature. In other words, truck-mounted brake cylinders and slack adjusters were applied. For this purpose, special castings were developed which are bolted to the truck frame. Since the cars are now designed to brake at 187 per cent in full service and 250 per cent in emergency at high speed, it was necessary to strengthen the clasp brake rigging and to reinforce the truck frame to withstand the forces generated by these high braking ratios. The steel wheels used in these trucks are machined with cylindrical treads.

Testing Wrought Steel Wheels

(*Continued from page 350*)

drag test. Fig. 7 shows the rate of increase of stress with different braking cycles. The stress values plotted are the highest stress measured on the plate of the wheel. These were usually in compression in the radial direction.

In order to re-enact wheel failures on the test machine the thermal cracking cycle was applied until one or more thermal cracks were caused to grow across the tread of the wheel. The light drag test cycle was then applied until the longest crack grew through the rim or at least one inch over the edge of the front rim face. This sometimes resulted in the development of more than one large crack. The method was modified and now the thermal cracking cycle is discontinued as soon as at least one crack is one in. long. The light drag test cycle is then used to cause the crack to grow across the tread. If the wheel has not ruptured up to this point, long light drags are applied until it does.

This procedure reproduces the sequence of steps that occasionally leads to a wheel failure in service. A wheel which failed after such a testing cycle is shown in Fig. 2. A comparison with the wheel in Fig. 1 which failed in service shows how well the testing procedure duplicates service conditions.

If several large thermal cracks form and grow through the rim the effect of the built-up stress is divided between them. Failure on the testing machine then requires more drag test applications than otherwise. To avoid this variable an alternate procedure has been used. A saw-cut is made halfway through the rim and a tight shim is fitted in it. No thermal cracking cycles are applied because the saw-cut simulates a deep crack. Stresses resulting from the drag tests are concentrated at the base of this saw-cut. The advantages of avoiding the effect of multiple cracks is somewhat offset by the fact that the saw-cut is not the same, either in sharpness or in depth as a thermal crack. It therefore does not represent service conditions as well as the first method. Both methods are being used and more data are needed to determine which is preferable.

Results

Presentation of results is confined to a few illustrative examples as a full discussion would exceed the scope of this paper. The stress build-up plotted against brake applications in Fig. 7 is the highest measured stress in the plate or web of the wheel. This was generally a compression stress in a radial direction.

Resistance of wheels to thermal cracking is influenced by chemical composition and heat treatment. The effect of carbon on the susceptibility to thermal cracking is shown in Fig. 8. The greater resistance of the lower carbon wheels to thermal cracking is now recognized by both wheel manufacturers and railroad users.[4] The difference between fine- and coarse-grained steel is also illustrated by these data. This is believed to result from the faster rates of transformation, hence reduced tendency for martensite formation, of fine-grained steels.

Rate of crack growth is as important a characteristic as the resistance to formation of the first thermal crack. If a crack grows rapidly there is less opportunity to discover it by inspection and to remove the wheel before it becomes dangerous. Rate of crack growth as related to carbon content is shown in Fig. 9.

The rate of stress build-up does not vary with composition or method of heat treatment, but different kinds of wheels differ in resistance to failure by drag testing. The latter doubtless depends on a number of factors such as design, composition, and method of heat treatment. Some of these are still being investigated.

Conclusions

1. Increasing severity of railroad operations has made it necessary to provide means for testing wrought steel car wheels under simulated service conditions. Only a small percentage of wheels fail in service; yet an examination of a number of these indicated that the heat from the brake shoes cause a structural transformation of the tread surface and builds up internal stresses that lead to the formation of thermal cracks and occasionally to complete rupture of the wheel.

2. Various cycles of brake applications and cooling have been developed to reproduce thermal cracking and plate failure of wheels in a manner similar to the rupture of occasional wheels in service. These testing procedures have been applied to the study of some of the variables in wheel manufacture. Much useful information has been obtained and this is already reflected in improvements in wrought steel wheels to meet the more exacting requirements of modern high-speed trains.

[4] A. S. T. M. Standard Specification for multiple wear wrought steel wheels A 57-46 provides three carbon ranges to meet various service conditions.

EDITORIALS

Car Economics

A number of points bearing on the economics of railway car design and utilization, brought out in a paper by L. K. Sillcox, first vice-president, New York Air Brake Company, at the recent A. A. R. Mechanical Division Convention at Atlantic City, seem worthy of special emphasis. In the case of passenger equipment, for example, attention was called to the fact that, in spite of intensive efforts to reduce car weight, the trend of unit weight per passenger carried is upwards.

Twenty years ago a coach weighing 130,900 lb. seated 84 passengers, whereas, a coach built in 1945 or 1946 and weighing 121,000 lb. may seat 56 or less. The indicated increase in weight per passenger in this case is 600 lb., or 38 per cent, as compared with a weight reduction of 7.5 per cent. With three 56-seat cars required to perform the transportation service possible with two 84-seat cars, it is obvious that railroads must now haul 181,500 lb. of dead weight for each 84 passenger seats as compared with 130,900 lb. in the 1920's. The value of lightweight equipment in railway passenger service is generally appreciated, but one question as yet unanswered is, how far can the railroads afford to depart from their primary role as the most efficient and economical means of mass land transportation by giving luxury service to a relatively smaller number of individual passengers.

With the first cost of new equipment two or three times that which it displaces, the paper referred to stated that such equipment must be used intensively. This can be done only by remedying conditions which are responsible for failures and delays, or otherwise hold equipment out of service, an important by-product of this work being reduced maintenance cost. Among other causes of train delays, the following are listed in their order of importance: Hot bearings, foundation brake gear failures, stuck brakes, coupler and draft gear defects, air-hose failures, wheel defects and broken piping.

The preceding list gives hot bearings as the most common single element in train delays and hence a difficult hurdle in the railroads' attempt to get maximum service miles per month and hence a high degree of utilization. Roller bearings contribute substantially to overcoming this difficulty in passenger equipment and undoubtedly would perform the same service on freight equipment if some means could be found to apply and finance them on a national basis. Like investments in lightweight freight cars, however, desirable progress cannot be expected until car owners are compensated equitably for expenditures on equipment which may be off the home road lines most of the time. The entire problem needs study on a national basis.

In connection with other items in the list of causes of train delays, original design is of major importance, also a material specifications and the thoroughness with which inspection and repair work is carried out. Attention to all of these details in a carefully developed program of preventive maintenance will do much to give increased utilization of railway equipment and better service at less cost.

Selecting Cars For Heavy Loads

Next to standardizing rules governing the condition of freight cars acceptable in interchange service, one of the most important contributions of the A. A. R., Mechanical Division, has been the aggressive steps taken to secure heavier loading of individual freight cars in the interest of efficiency and especially the loading of cars adapted to their respective commodities and in suitable condition to carry these commodities safely and quickly to destination.

Associated with the latter objective is the question of how to make sure that cars with heavy concentrated loads can be operated without accidents and delays en route. No later than May 1, Secretary A. C. Browning called attention to this matter in a circular letter containing a number of specific suggestions for improved practice which undoubtedly need prompt attention and appropriate action to overcome present difficulties.

Current, as well as past, experience indicates the very real problem which confronts railroads in transporting heavy concentrated commodities such as copper, lead, zinc, etc., in the form of bars and slabs. Serious accidents have been reported due to such commodities falling through freight-car floors onto the tracks, and in other instances the heavy lading has shifted causing failures due to uneven distribution of the load.

Reports covering these accidents and near accidents indicate a number of primary causes. In some cases, floor defects exist before cars are loaded. In others, structural members of the cars which support or reinforce the floor are weak. The lack of suitable floor reinforcement in places where needed between the center and side sills is another cause; also floor defects caused by shippers' use of heavy lift trucks. Still another factor is the insecure locking and bracing of load units which permit them to become loose and shift under vertical vibration and shocks incident to normal freight-train operation.

Remedial action suggested by the A. A. R., Mechanical Division, includes first the assignment of cars for this particular kind of loading by inspectors or super-

visors who have a full knowledge of the commodity to be loaded, as well as car construction, loading and bracing methods. Close inspection to detect indications of possible failure of floors and floor supports before the failure occurs is of primary importance. More detailed supervision of loading practices and methods of blocking and bracing loads at the point of origin is indicated; also the application of substantial floor supports to as many cars as possible between the center and side sills and extending the full length of the car. Instructions covering this strengthening of car floors and supports have been covered by previous circular letters issued by the A. A. R. Mechanical Division.

Manning the Electric Shop

Electrical repair shops for Diesel-electric locomotives, as they are growing up about the country, are all similar in many respects but no two are alike. The points of difference are made up in part by preferences of individual shop operators, but rather more by operating conditions. If a railroad operates switchers only, the shop operator has requirements which are quite different from those on a railroad which operates road power. If his operation is restricted to a relatively small area, his needs differ materially from those on a railroad with long lines. If he is remote from manufacturers' repair shops, he must have more complete facilities of his own. If his needs are small, or if he lacks skilled operators, he will probably decide to have all his motor and generator winding done outside.

In any case, the shop operator must decide what facilities and machinery to have in his shop and must determine to what extent to man the shop. With the growing use of Diesel-electric locomotives, it seems obvious that the facilities should be adequate to allow for future expansion. In other words, the shop should be equipped to do more of the work he has decided to perform in his own shop.

The case for manpower is a little different. In spite of all efforts the shop operator may make to maintain shop schedules, there will be peaks and valleys in the work requirements. There will be times when there is much work to do and other times when there is little. If his manpower is just enough to take care of average requirements, he will get behind when there is much work to do. If his manpower is sufficient to take care of peak loads, he will promote inefficiency in his shop. If there are just men enough to fulfill minimum requirements, he will be unable to do all the work that must be done.

Considered by itself, the latter situation is ridiculous. But if the railroad shop operator is willing to concede the advantages offered by outside shops, this is an ideal situation. If he has a staff sufficient to meet minimum requirements, and sends the remainder of the work out to the manufacturers' repair shop, he is assured that he will always have a steady flow of work through his own shop. Such an arrangement will also permit of getting work done in minimum time and will, therefore, reduce the number of spare motors and generators he must carry to assure uninterrupted operation of locomotives. It might appear that if the outside shop must handle peaks only, it must work inefficiently and, therefore, be obliged to charge high prices for repair work. But they can enjoy at least a reasonably smooth flow of work if they serve several railroads. The different railroad peaks would seldom occur simultaneously, and this circumstance, together with their doing other than railroad work, should cause a diversity which would enable them to maintain uniform schedules. Competition between the shops, too, should be a healthy influence. It may be that some roads may prefer to keep all responsibility for work standards within their own shops, but it would scarcely appear that this would be a sufficient reason to compensate for the advantages of having the outside shop take care of peak load requirements.

Diesel Identification

Now that frequent reference must be made to Diesel locomotive types there is a definite need for a simple classification system that will identify the arrangement and function of each wheel in any design of this kind of motive power. Several systems have been devised for classifying locomotives but most of them were developed specifically for describing the wheel arrangements of *steam* locomotives.

All of the steam-locomotive systems have their proponents but none have been more generally used than the one developed by F. M. Whyte. Using numerals separated by hyphens to designate wheel groups, the Whyte system is a simple method for classifying steam locomotives by types. When a steam locomotive is referred to as a 4-8-4 the numerical symbols convey clearly that the locomotive has three wheel groups, the first being a four-wheel leading truck, the second composed of eight driving wheels and finally, a four-wheel trailing truck. As all steam locomotives have wheel groups in which each wheel in each group is identical in size and function to every other wheel in that group, the system was both flexible and adaptable enough to identity within rather close limits any design of that type of motive power.

The Whyte system, however, is not as descriptive when it is used to classify a Diesel locomotive because this type of motive power may have both idling and driving wheels in the same wheel group. Of the systems now developed, the Continental appears to be the one that would serve best to describe the Diesel. In this system numerals and capital letters are used, respectively, to designate idling axles and driving axles; the letter A indicating one driving axle, B, two driving

axles, C, three driving axles, etc. A plus (+) sign indicates an articulated truck connection.

Thus, a locomotive with two non-articulated six-wheel trucks and having two driving axles on the outside of each truck with an idling axle in between would be designated an 0-6-6-0 by the Whyte system and an A1A-A1A by the Continental. A Diesel with two four-wheel trucks with all axles driving would be a B-B type using the Continental system. A Diesel with a two-axle guiding truck at each end and two four-axle articulated driving trucks with a motor on each axle would be a 2-D+D-2 type.

Here is an opportunity to adopt a classification system for the Diesel that would avoid a great deal of confusion. Although a bit more complicated than the system used to designate steam locomotive types, the Continental system is the best one devised so far for the purpose. It is brief and more descriptive.

Two Shows For One Admission

Now, with the "big show" at Atlantic City behind us, the men of the mechanical departments of American railroads can concentrate on the job of preparing for the Allied Mechanical Association meetings at Chicago in September. The sessions of the A. A. R. Mechanical Division, which have just been concluded, bore many evidences of the influence of the work of the so-called minor mechanical associations. This is as it should be for the great part of the personnel of the minor associations is made up of the men who are out on the firing line living with the equipment the design and maintenance standards of which are established by the Mechanical Division. It is but logical that the experiences of these supervisors with the difficulties of inspection, maintenance and servicing should reveal whatever weaknesses there may be in equipment and place them in a position to make suggestions to the Mechanical Division for revision of standards.

Since the resumption of the meetings of the Car Department Officers' Association, the Master Boiler Makers' Association, the Locomotive Maintenance Officers' Association and the Railway Fuel and Traveling Engineers' Association in the years immediately preceding the war, these groups have made outstanding progress in the quality and character of the individual papers and committee reports that make up their programs. Even at this early date, so much of the work of many of the committees of the four associations has been completed that we are able to say, without fear of contradiction, that the meetings to be held at the Hotel Sherman, September 15 to 18 inclusive, will probably be the most educational and productive meetings of these groups ever to be held. There are innumerable problems of great consequence that must be considered in the coming months and there is no better way for any railroad supervisor to find help in the solution of these problems than by his being in attendance at these conventions.

An added attraction this year is the first Machine Tool Show to be held for several years, from September 17 to 26 at the Tucker Corporation Automotive Plant, Chicago. Many railroads, in assigning men to go to the Chicago conventions have allowed additional time and made plans for their men to see the exhibits and to attend the technical sessions of the Machine Tool Show and the Machine Tool Congress. The railway supply manufacturers who will participate in the exhibit at the Hotel Sherman, as well as the machine tool builders in whose products railroad men have an interest, will make heavy expenditures to build these exhibits for the benefit of the industry. It is to be hoped that supervisors, representing railroads from all parts of North America will take advantage of this opportunity.

Keeping Motive Power on the Go

Elsewhere in this issue appears the first part of an article describing enginehouse maintenance procedures on the New York Central's Niagara-type locomotives, which have been making an enviable record in high mileage and reliability of operation. A glance at the chart of the movements of six test locomotives for the month of October, 1946, shows what can be done when close attention is paid to getting locomotives in and out of the enginehouse. It shows further that there is no inherent reason why a good steam locomotive cannot run long distances virtually every day of the month without being taken out of service or held up in the enginehouse while awaiting its turn for repairs.

Of utmost importance in the attainment of high mileage for any type of power is keeping it on the road. A locomotive sitting in an enginehouse makes no mileage. It is only common sense to give priority routing to the best locomotives to enable them to do the greatest possible share of train hauling. New locomotives should not be made to wait their turn for entrance into the enginehouse or for repair work to be done upon them after they are in.

The assignment of manpower is likewise important. With a given amount of repair work to be performed, the more men that can be assigned to a locomotive, the fewer the required hours will be to complete the job. By assigning a sizeable number of men to the latest power, the modern locomotive will be dispatched quickly and enabled to perform additional revenue service, without adding to the total number or cost of the servicing man hours. Whether this penalizes second-class power or not, by delaying their turn for work to be done, is not of primary importance. The important consideration is that almost without exception modern power will do a given job better and cheaper than older power, and therefore every step taken to increase their share of the total traffic moved is a step toward greater economy of operation.

With the Car Foremen and Inspectors

Milwaukee

Passenger Truck Shop

SPACE for the new Milwaukee passenger truck shop, referred to in the May *Railway Mechanical Engineer*, was found between the old coach shop and another general shop building. This space is slightly over 54 ft. wide by 455 ft. long. A pre-cast, monitor-type concrete roof was constructed over this area with the lower chords of the roof trusses located 18 ft. 10 in. above the concrete shop floor in which two longitudinal tracks, spaced 16 ft. on centers, extend to within 50 ft. of the west end wall and 40 ft. of the east end of the shop.

Both end walls, which close the space between the two old shop buildings, contain large areas of glass and, in conjunction with two large panels of roof windows extending the full length of the shop, give exceptionally good lighting conditions during the daytime. Artificial light when needed is supplied by three rows of overhead reflector-type lamps suspended from the roof framing, which also supports the unit-type heaters used in heating the shop.

The shop is served by a 15-ton overhead traveling crane which is operated either from the usual cab or by push-button control from the shop floor and moves on rails 14 ft. 4 in. above the shop floor. This crane runway, details of the roof construction and excellent daylight conditions in the shop are shown in one of the larger illustrations which also shows in the foreground a Whiting press especially designed for removing and reapplying truck bolster springs.

At the east end of the shop a low-roof brick extension to the building gives space for three 40-ft. wash tracks on one side of the doorway and an 11-ft. by 40-ft. paint-spray booth on the other side. The spray booth is equipped with an exhaust fan of large capacity with exhaust pipe extending directly up through the low roof to a height sufficient to dispose of paint spray fumes safely. The floor directly under the trucks being sprayed consists of a steel grating over a partially filled water pan which collects surplus paint and avoids the necessity of periodic scraping of paint accumulations from the floor as ordinarily required. Electric lights in this spray booth are vapor proof and enough of them are provided to assure clear visibility. The exhaust fan keeps air in the spray booth in suitable condition for working at all times.

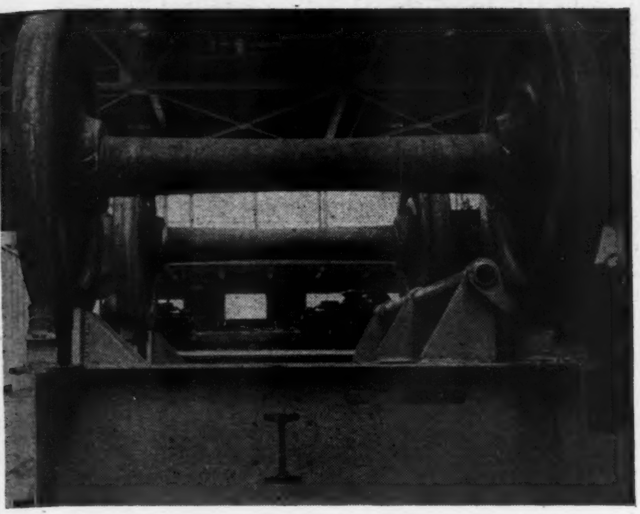
One of the illustrations gives a view of the truck shop practically full of trucks in various stages of construction. It is intended eventually to assemble the trucks on a straight-line basis, but for the present, owing to local conditions, each truck is completed at the spot where the truck frame is originally placed on suitable blocks.

Two machines which greatly facilitate work in the truck shop include, as shown in the illustrations, a

A low brick extension on the east end of the truck shop houses wash tracks and part of the paint-spray booth

Work in progress on two tracks of Milwaukee passenger truck shop

Truck-squaring jig which does much to increase production and accuracy in truck-assembly work



The squaring jig with two pairs of mounted wheels in place

truck-squaring jig which speeds production and increases the accuracy in assembling trucks, and the Whiting spring press already mentioned. The squaring jig is exclusively a Milwaukee development and the spring press, also a Milwaukee design, utilizes power units furnished by the Whiting Corporation.

The truck squaring jig, clearly shown in one of the illustrations, consists of two 20-in. I-beams, 10 ft. long, spaced 5 ft. 1¼ in. on centers, and three cross I-beams of the same size, spaced 3 ft. 6 in. on centers, all of these beams being cut out at the ends as required and welded into a rigid square foundation structure. The jig is placed over one of the tracks in the truck shop but, as a self-contained unit, does not necessarily have to be bolted or otherwise secured to the shop floor.

Four wheel-positioning V-blocks are installed one at each corner of the jig, the nearer pair being fixed in position by welding to the I-beam flanges as illustrated. The other pair of V-blocks *BB*, at the further end of the jig, are movable by means of enclosed racks and gears, mounted on a 2¼-in. cross shaft *S* which makes the jig adjustable to accommodate trucks with different wheel spacings by simply applying a crank to the squared right end of shaft *S* and turning it the required amount. As a matter of fact, Milwaukee trucks usually squared in this jig had either 7-ft. or 8-ft. wheel spacings.

All four V-blocks are positioned on the jig so that when they support two pairs of mounted car wheels the axles are accurately parallel. To assure accurate wheel alignment and a square truck, wheels at the left are pulled up against positioning plates *PP* by lever operation of 2⅞-in. pipe *L* which is supported in three brackets welded to the cross I-beams, as shown, and equipped with a cam or finger at each end (one shown at *C*). When pipe *P* is revolved, these two cams bear against the inside faces of wheels on that side of the jig and force the entire wheel assemblies to the right until stopped by positioning plates *PP*. This operation is better indicated in the illustration which shows two pairs of mounted wheels in place on the jig.

The use of this jig as described, therefore, holds the wheels accurately positioned with regard to wheel spacing and squareness. Mounted wheels are placed on the jig with roller-bearing journal boxes in place and the first operation in assembling the trucks is to gauge the journal boxes and either grind the pedestal bearing surfaces or apply new wear plates to give standard width and equal spacing from the dowel pin holes. The equalizer housings are then gauged and ground or shimmed to standard and applied with the shop crane on the journal boxes. An immediate check is obtained on previous work if the equalizers go over the journal boxes and fit with less than $\frac{1}{16}$ in. play on either side of each box.

The truck frame is then applied with wood blocks 14½ in. high in the equalizer coil spring seats which support the frame at normal working height. The truck frame is squared with the equalizers longitudinally and laterally and the frame is held with wedges between the equalizer and frame and between the frame and wheels so that it cannot move.

The bolster is applied, resting on wood blocks 17½ in. high in the bolster coil spring seats. The longitudinal truck anchor brackets are then put in place, lined, leveled off and welded. The truck and link pins are welded to the frame and the equalizer for lateral control. The slack adjuster and cylinder lever guide brackets are properly positioned by spot welding. All rubber bushings and pads on the positioning rods are removed and the truck taken out of the jig and placed on the welding track where welding operations are completed.

Equalizer coil springs are applied in place of the wood blocks, using the shop crane, and bolster positioning bars are installed, all rubber parts being replaced in the truck. Vertical and lateral shock absorbers and brackets are applied but with one end free, to be welded

Truck-spring press which facilitates applying and removing springs

later after the car has been regulated, levelled and platform and coupler heights adjusted.

The trucks then go to the spray booth where two coats of truck enamel are applied, each coat requiring approximately four hours to dry, after which the trucks are placed under the cars and put on a pit in the coach shop where the bolster springs are put in, using two 35-ton Joyce hydraulic jacks.

The truck spring press, shown in another illustration, is constructed over a T-shape pit in one of the trucks, the longitudinal pit being 12 ft. long by 6 ft. wide by 5 ft. 11 in. deep and the cross pit practically 14 ft. long by 3 ft. wide by 7 ft. deep. Entrance to this pit is secured by means of steps at one end.

This press consists essentially of a heavy steel frame set vertically in the concrete foundation and equipped with two horizontal moving beams, one shown above

the shop floor and the other operating in the pit beneath the floor, where it can be used through suitable blocking to exert a lifting pressure on any desired part of the truck. With the upper beam moving downward, a squeeze can then be put between the truck spring plank and bolster until enough space is available for easy removal or insertion of bolster springs.

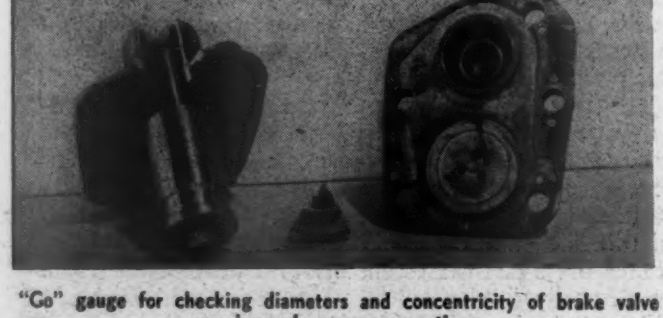
Referring to the illustration, the construction of the press will be apparent. The vertical side members of the steel frame are 12-in. by 10-in. H-beams, 17 ft. long overall, spaced 13 ft. apart on centers and firmly riveted at the top to two 15-in. channels. The vertical H-beams are also united at the bottom by two 15-in. channels set in the foundation. Each lifting beam is a 12-in. by 12-in. H-section, actuated by a 20-hp. 220-volt motor, double screws and jacks, supplied by the Whiting Corporation and installed as illustrated. The total travel of each beam is about 3 ft. and it moves at the rate of 6 in. per min.

One of the illustrations shows how the press is used to move elliptic springs from a six-wheel passenger car truck which is seen lined up in the press. Blocks are applied on the bottom lifting beam and run up to the spring plank to take the load off the journals. Another set of blocks is applied on the bolster ends and the top lifting beam is run down until it bears on the bolster. Further movement in this direction compresses the elliptic springs about 2 in. Spring bands or clamps are applied to keep the springs compressed and wedges put in place to hold the clamps. The top beam is raised slightly and the bottom beam lowered to clear the brake rigging, the truck pushed forward to the other bolster position, and the operation repeated.

In the case of coil-spring trucks the truck is run under the machine until the center is in line with the lifting beams. Blocks are then set on the side bearings, the top beam brought down in contact with the blocks and rail sections removed. Then 10- to 12-in. blocks on the bottom beam are brought up in contact with the spring plank and raised until the swing hangers can be removed. The bolster is then secured in the truck frame so it will not drop out when the spring press is removed. The bottom beam is lowered about 24 in. until the coil springs can be removed. Reverse operations are followed in re-applying the springs.

Brake Valve Concentricity Gauge

To check the concentricity between the brake valve main service piston guide of the service portion and the outer bushing in the service portion cover, a gauge has been designed and built by the shop forces of the Reading, Pa., shops of the Reading. This gauge consists of a finely machined cylindrical rod to fit the piston guide. Over this rod fits another cylindrical member which checks the diameter of the outer bushing and the concentricity of this bushing with the piston guide. To use this gauge the small rod is inserted into the guide bushing. If the casting is satisfactory in diametrical dimensions and concentricity, the larger rod will slip into the outer bushing.



"Go" gauge for checking diameters and concentricity of brake valve service and emergency portions

The purpose of this gauge is to note any distortion of the cast-integral bushing which might have resulted from distortion of the cover and which would cause the slide valve to lift off of its seat. This "Go" gauge is also suitable for checking the cover on the emergency portion.

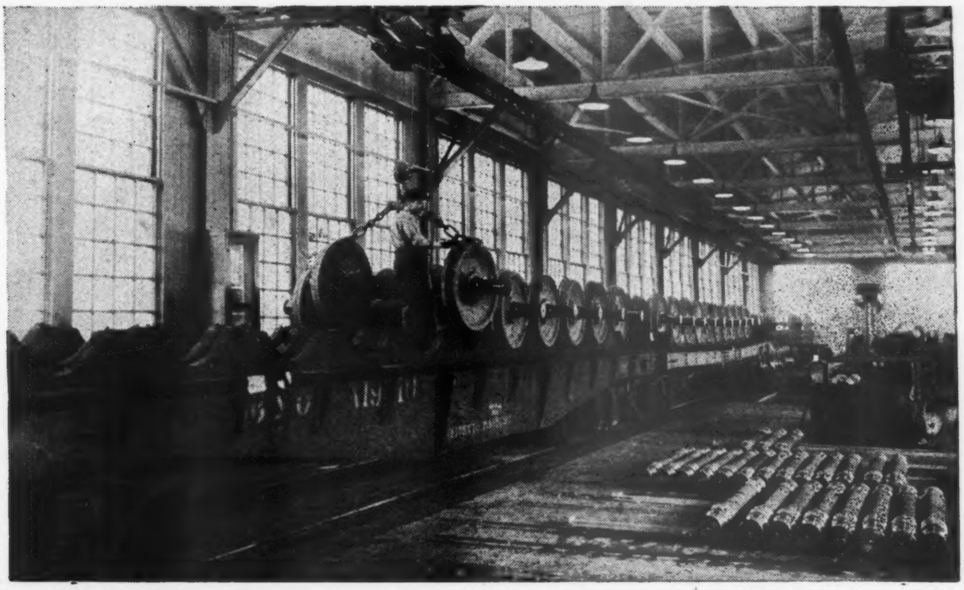
Removing Bulges in Welded Passenger-Car Sides

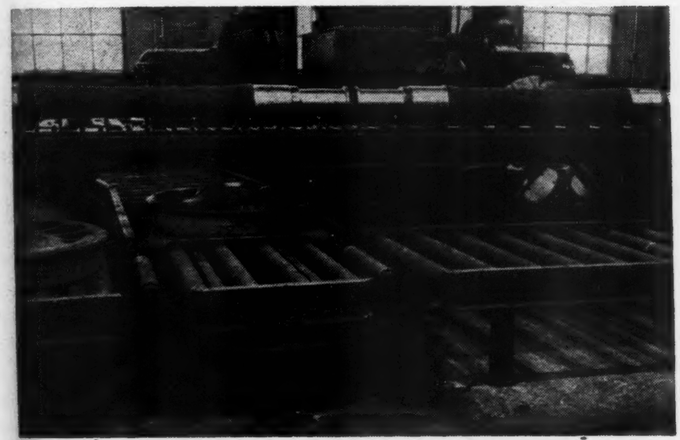
The Canadian National is using a water-ring heater to remove bulges caused by welding of passenger-car side sheets. The water-ring heater consists of a circle of ½-in. pipe about 5 in. in diameter, in which are drilled a number of $\frac{1}{16}$-in. holes, and an oxy-acetylene torch clamped to the ring.

Removing a bulge in a welded passenger-car side at the Canadian National's Point St. Charles shops—Better use is normally made of the goggles; they were raised momentarily while the picture was snapped

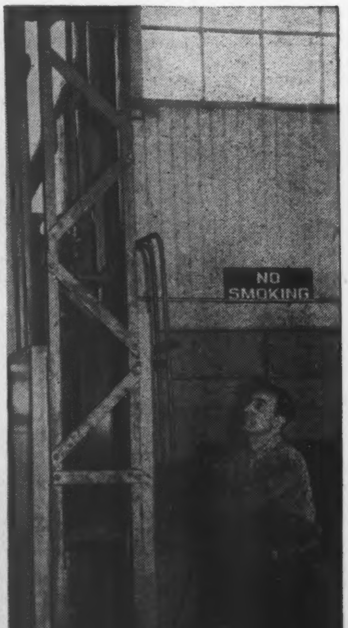
In operation, streams of cold water are directed onto the steel plate and, at the same time, the torch flame heats a small area of the plate in the center of the water ring to a red heat. The heated portion of the plate expands and, being constrained by the surrounding metal cooled by water, it is crushed in the area subjected to the red heat. When cooled, the portion that was heated pulls on the surrounding metal in contracting and tends to remove the bulge and straighten the plate. A succession of local heats, depending in number on the area and depth of the bulge, are applied.

Wheel Shop Handling Devices





At the Glenwood wheel shop of the Baltimore & Ohio the finished wheel pairs may be loaded inside the shop for shipment to other wheel-changing points on the railroad. In the top illustration a pair of wheels is shown being lowered on to a car by means of one of the overhead traveling cranes equipped with a three-ton electric hoist and using a chain wheel sling. At the left a machined wheel is shown on a roller conveyor coming from a boring mill and waiting at the turntable for movement on to the roller conveyor which will take it to the mounting press. Above the wheel is shown a section of the 154-ft. motor-driven pallet conveyor which transports the finished axles from the lathes to the mounting press. The illustrations at the bottom of the page show a scrap wheel being lifted from the wheel dolly by a jib crane with an air hoist (left), swung around into the wheel elevator (center), and raised eight feet (right) to the opening to the outside wheel chute. The elevator cage is powered by a 1,500-lb. air hoist. [Other handling devices used at this shop were described on pages 78, 137 and 186 of the February, March and April, 1947, issues, respectively.—Editor]



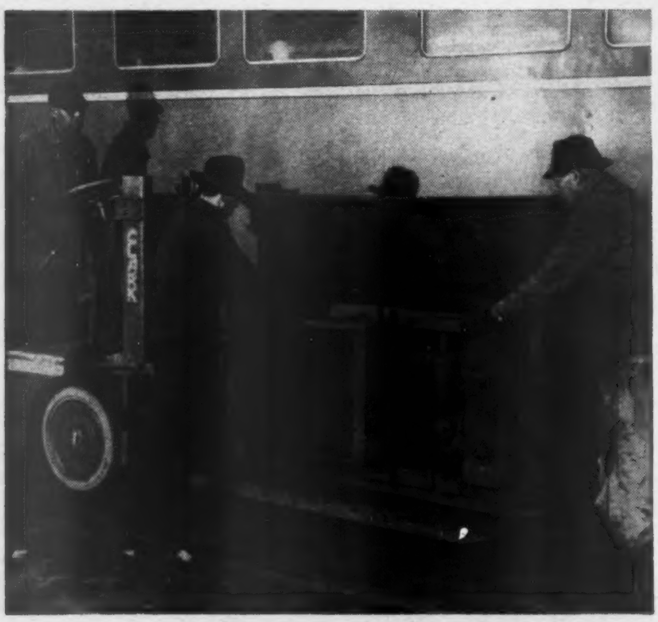
Air-Conditioning Equipment Overhauled*

In anticipation of the cooling season each year, 20 air-conditioning men at the California avenue, Chicago, yards of the Chicago & North Western, overhaul air-cooling equipment for passenger cars of this road. At present there are about 200 of these cars, wholly owned by the North Western and equipped with units which go through this overhaul. These do not include the several hundred air-conditioned cars jointly owned with the Union Pacific, Southern Pacific and Pullman sleeping cars operated by the North Western.

The units, known as Waukesha ice engines, are removed each fall and taken into the shop where they are overhauled on a production line basis and, depending upon their condition, given light, medium, or heavy classified repairs. The first includes thorough cleaning of all parts; checking the propane gas engine and the Freon compressor; and a complete test on the test rack. This work is done on all units received which have less than 500 hr. of service.

* From the North Western Newsliner, April issue.

Circulating Oakite cleaning solution with electric pump



Reapplying a repaired Waukesha air-conditioning unit to a streamline passenger car

Medium repairs consist of the same work done in light repairs plus grinding valves. This attention is given to all Waukesha units received at the shop which have over 500 hr. of service.

Heavy repairs, which consist of complete dismantling of unit, renewal of rings, pistons, bearings, etc., are done only when authorized by supervisor. No time limit is set for this class of work as general performance, oil consumption and conditions under which units operate greatly vary time limit for heavy overhaul.

The overhaul line is set up on an eight-position basis for the repair of air-conditioning units. Two additional positions on a separate line are used for repairing engine-generator units, which also are overhauled on a semi-annual basis, with three men assigned to this work.

Left: Removing engine radiator—Center: Checking control box of ice engine—Right: Test station for propane regulator, electric solenoid and expansion valves, also Ensign fuel regulating valves

Special shop equipment used in overhauling the Waukesha ice engines includes eight four-wheel dollies on a narrow-gauge track for supporting the engines and moving them from one position to the next; an overhead mono-rail and one-ton electric hoist which serves the complete assembly line, and test plant equipment, including a regular passenger car set-up for testing all equipment after it has been repaired.

At present the mono-rail hoist is used to place engines on their sides on the dollies for ease of working, but a jig now under construction will effect further improvement by supporting the complete engine frame in such a way that it can be revolved and held at any angle required for the most efficient handling of the work.

Waukesha air-conditioning unit repair line at the Chicago & North Western shop

The sequence of operations in overhauling the air-conditioning units is as follows: Each unit is taken from the car and moved without manual labor by a Clark lift truck to the shop where the mono-rail electric hoist is used to mount the engine and frame on one of the dollies at the first position. Here the engine and radiator are washed with a solution of Oakite. The engine is dismantled and all parts removed for thorough cleaning, checking and repairing.

The unit then moves progressively through Positions 2 to 7 inclusive where repairs are made to all moving and operating parts of the engine and compressor. The equipment is then assembled ready for test. In case one engine requires heavier work than another, the mono-rail hoist is available to jump other units over it and thus maintain daily output of the shop.

At Position 8, the unit is put on the test rack, connected to a regular passenger-car set-up, and given a test for four hours under low and high temperature operating conditions. Steam heat is used to get high temperatures and restricted air flow over the condenser to build up the high pressure side of the Freon system and work the engine under load.

After satisfactory testing, the unit is removed from the shop, painted and either put in storage for the summer air-conditioning season, or applied on streamline cars which require air-conditioning all the year around.

At the two engine-generator repair positions, these units get light repairs every six months and heavy repairs every 18 months. This work includes grinding valves; overhauling and checking all automatic equipment; dismantling the generator; checking armature field coils and commutator brush rigging and bearings. The units are then tested under load, charging car batteries for a period of three hours and checked for heating. Engine-generator controls are given a final check.

Repair bench equipment and operations

Distortion Control in Parts Built-Up by Welding

The problem of distortion in metal, frequently met when building up worn surfaces with arc welding where the amount of weld metal to be deposited is large in proportion to the parent metal, can be minimized if certain precautions are taken, according to General Electric welding engineers.

If the surface to be built up is not already worn smooth, it should be ground smooth. Pre-heating to unlock stresses is helpful, if permissible. Electrode size should be small, and the current kept in the midrange for that size to prevent excessive local heating.

Beads should be kept thin and should be well peened, Only small areas should be covered between peenings. alternate layers should be laid at right angles. Plenty of pressure on the wire brush between welds will help yield sound metal build-up. Adjacent beads should overlap about 40 per cent of bead width.

Coast to Coast Pullman Service. A Pullman car service for coast-to-coast travelers on the so-called Washington-Sunset route between New York and Los Angeles, Calif., was inaugurated on June 1 by the Southern, the Pennsylvania, the Atlanta & West Point, the Louisville & Nashville and the Southern Pacific. The new service provides through car advantages between the two cities, with a sightseeing stopover at New Orleans, La., the participating railroads state. Westbound, the air-conditioned standard Pullmans assigned to the new service are carried on the "Piedmont Limited" from New York to Montgomery, Ala., the "Pan American" to New Orleans and the "Sunset Limited" from New Orleans to Los Angeles. Eastbound, the service will be provided on the "Sunset Limited" to New Orleans, then the "Crescent Limited" to New York.

IN THE BACK SHOP AND ENGINEHOUSE

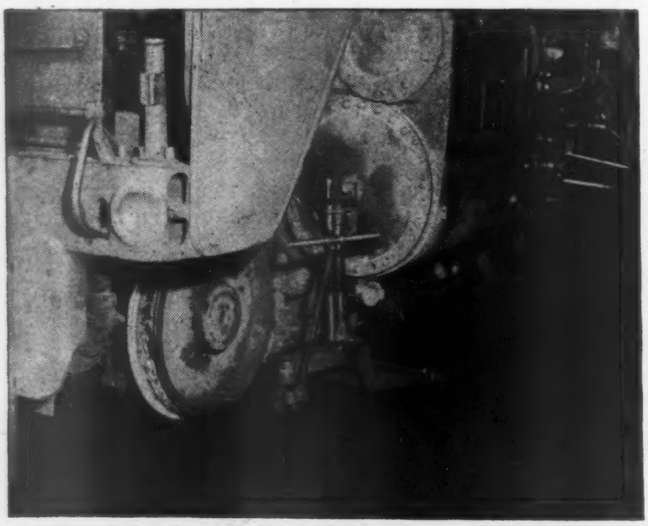
Enginehouse Procedures on

New York Central Niagaras

Part I

This first installment of a description of enginehouse maintenance methods covers daily and monthly inspections – Quarterly inspections will be described in a later issue

THE New York Central has assigned six of its Class-S 4-8-4 type locomotives to a test program to determine the utilization possibilities of coal-fired steam power. The results of this test so far have indicated that modern, well-designed steam locomotives such as these "Niagaras" are capable of exceeding 25,000 miles a month. This is



An adjustable rig made at the west Albany shops is used to remove and replace cylinder heads and for holding them while inspecting the cylinder interior, piston and packing

made possible by using these locomotives on long, fast through runs and by keeping enginehouse time to a minimum. Both monthly boiler washes and daily inspections and repairs are completed between runs, all of which in the case of the six test locomotives arrives at Harmon, N. Y., from Chicago in the morning and depart in the late afternoon. Quarterly inspections and repairs are usually performed with an average out-of-service time of only 36 to 48 hours, during which time necessary work is performed on the locomotive to make it suitable for a service of another 60 to 80 thousand miles before its next quarterly inspection.

Several factors contribute to keeping to a minimum the time required for all types of inspection and repairs. As the number of man-hours required to perform the necessary work are not appreciably affected by the total time the locomotive is under repair, there must necessarily be more men assigned to the engine to complete the job in less time. The key to the entire program for the rapid handling of the test locomotives lies, therefore, in an efficient and flexible organization of man-power. No special facilities have been provided at Harmon or other enginehouses. Other factors contributing to the rapid turn-around times on daily, monthly, quarterly and annual inspection and repairs include giving the test locomotives priority over other power on the inbound track and in having available extra parts, such as spare crossheads, rods, and driving wheels. Design features such as roller bearings, one-piece beds, extensive lubrication, light-weight reciprocating parts, and ample boiler capacity have an important bearing on the ability of these locomotives to make long trips at high speeds virtually day after day without being held out of service for repairs.

Daily Inspection

Of primary importance in the matter of guaranteeing the consistent completion of daily work between runs is the assignment of inspectors to the locomotive immediately following its priority entrance into the enginehouse. By this means all inspections can be completed quickly and the necessary work lined up. If repairs over

Removing the right throat steet washout plug

and above those usually encountered in daily work are required, the necessary manpower can be assigned to the job early enough to give the enginehouse forces an excellent chance of getting the locomotive in shape for its regularily assigned run.

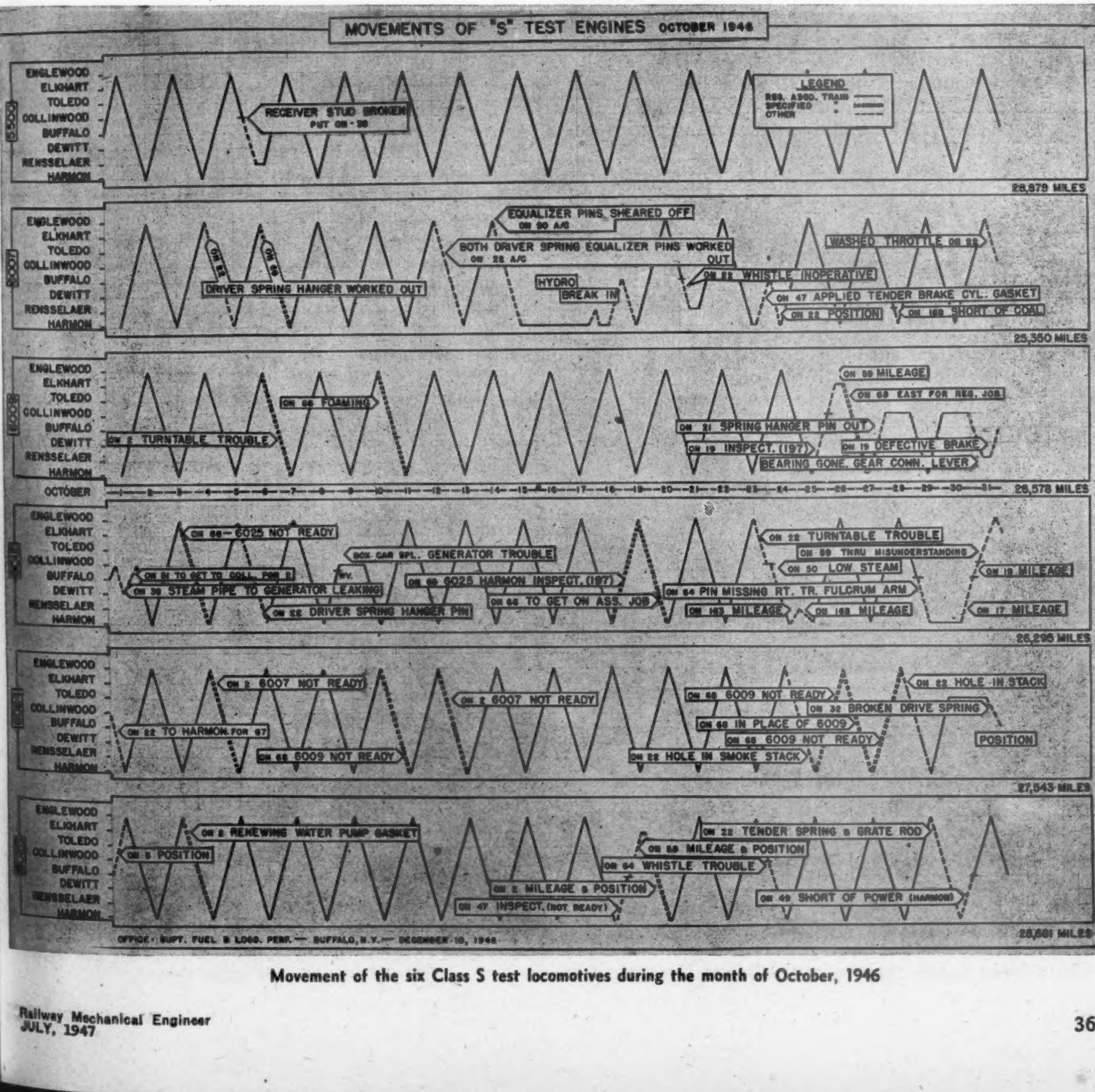
The skeleton organization for the daily inspection of and repairs to the machinery consists of an air-brake inspector and helper to make the brake system inspection and to do minor repairs, and a machinery inspector to inspect all the machinery. The machinery inspector is followed by such workmen as it is found necessary to assign. The boiler gang has two hot inspectors, a boilermaker and helper to inspect and make minor repairs to the boiler, and a boilermaker and helper to handle the inspection of and repairs to the ash pan and front end. Where arch bricks require renewal, two boilermakers with two helpers and two laborers are assigned. Three flue blowers and two flue washers are available.

Boiler Wash in Eight Hours

The monthly boiler wash and inspection is normally completed in about eight hours in order to have the locomotive ready for its assigned run. Again organization, both in the assignment of workers and in the scheduling of the locomotive through the house, plays a key role. Upon being detached from its train, the locomotive is routed to the ash-pit track with a minimum of delay. Here it receives coal and sand at the supply shed and has its fire dumped and its ash pan flushed on the pit. While this work is being done the tender and cab exterior are cleaned by hand brushes. On the way into the house, the running gear and the boiler jacket are cleaned with an automatic spray machine. Upon arrival in the house blowing down the boiler begins.

The boiler is blown down through a 1½-in. orifice to prevent too rapid cooling. During the cooling period the water level is maintained by the injector. The water is supplied at a temperature of 160 to 185 deg. F. until the boiler pressure drops to a point at which low pressure causes the injector to become inoperative. The total time required for blowing and cooling the boiler down averages from 1½ to 1¾ hr. In the event there is any delay between the completion of the boiler cooling and the beginning of the boiler wash proper, the water is left in the boiler until the wash is about to begin to keep the scale soft.

The boiler is washed with water at a pressure of 120 lb. per sq. in. and at a temperature of 120 to 130 deg. F., the latter being held within these limits by a thermostatic control valve. The time required for the actual washing varies from 3½ to 4 hr. This includes removing the washout plugs, cleaning the grates, washing the flues,



Movement of the six Class S test locomotives during the month of October, 1946

A long-handle wrench being used to remove the left forward belly plug

and replacing the plugs. Approximately one hour is required to resteam the boiler.

In resteaming the boiler, hot water alone is admitted until the level reaches the bottom cock of the water gauge glass. From this point on a mixture of steam and water is admitted. When the boiler is completely filled with water the throttle is washed out, and the superheater units tested, after which the proper water level is restored. About one hour before the locomotive is to be dispatched the fire is lighted.

A typical example of performing this work between runs is shown by the following log of Locomotive No. 6012, which received a monthly boiler wash and inspection on April 10, 1947:

8:30 Locomotive arrived on ash pit track.
8:35 Hostler took engine to supply shed for coal and sand.
8:50 Arrived on ash pit. Began cleaning fire and ash pan. Began cleaning tender and cab exterior by hand brush.
9:15 Completed cleaning fire and ash pan. Completed cleaning tender and cab exterior.
9:20 } Running engine through automatic spray to
9:25 } clean lower part of locomotive.
9:30 Locomotive across the turntable.
9:40 Began cooling down boiler.
10:50 Completed cooling down boiler. Began removing washout plugs and arch brick.
11:50 Completed removal of arch brick.
12:15 Began blowing all flues.
12:20 Started boiler wash.
1:30 Completed blowing flues. Began washing flues.
2:00 Completed washing boiler.
2:30 Completed washing flues.
3:45 Began replacing arch brick.
3:50 Began filling boiler with hot water.
4:05 Completed installation of new arch brick.
4:10 Tested superheater units and washed throttle.
4:30 Locomotive steamed and ready for lighting fire and dispatchment.

Organization and Work Done

To complete the boiler wash in the allotted time, the boiler gang is divided as follows:

One boiler inspector and three helpers do the actual washing of the boiler.

One helper cleans the tank.

One helper removes the arch brick.

One helper cleans the flues.

Other boilermakers, helpers and laborers are assigned to such work as is found necessary by the inspector.

In addition to work required by I.C.C. rules, the following are the major items of inspection and repair performed at the monthly boiler wash and inspection:

1—The side and back curtains and the hood are repaired or renewed and all unnecessary cab openings closed.

2—The superheater units and steam pipes are tested with water pressure at approximately 150 lb. per sq. in.

3—The multiple throttle is washed out.

4—The exhaust nozzle bridge is examined, ring blowers and pipe lines steam tested at 15 lb. per sq. in. and the tips cleaned.

5—Eccentric rods, pins and cranks are removed, cleaned and magnafluxed on the piston-valve locomotives.

6—The front-end main rod lateral is checked.

7—The condition of the cylinder packing is examined and a measurement of the packing wear is taken.

8—Boiler checks are ground in, shut-off valves checked and repaired. The intermediate check valve of the feedwater pump discharge line is examined and ground in.

9—All universal joints to valves in and outside of the cab are inspected and repaired.

10—Low-water alarm bodies are washed out and the main openings reamed. After the locomotive is fired up the alarm is tested.

11—The stoker distributing jets are renewed if worn and the hook bolts tightened if loose. The bonnets and stems of the by-pass valves in the individual jet valves are examined for wear and renewed or repacked as necessary.

12—The oil is drained and changed in the cold-water centrifugal feedwater pump.

13—The force-feed lubricator is operated by hand to make sure the pipes are open and free of leakage.

14—The grates, grate rigging, and carrier irons are checked for defects.

No major change is required in the line-up of the machinery gang as compared with that for daily work. Machinists' work required above and beyond that done at daily inspections consists largely of a group of small jobs such as grinding in boiler checks, repacking all cab valves, reaming the water gauges, testing the low-water alarm etc. For the bigger jobs, machinists with helpers are assigned. One pair cleans, Magnafluxes and inspects the motion work. Another pair removes

Time is saved in washing the locomotive and its running gear by the use of an automatic spray cleaner

the cylinder heads and examines the cylinder packing. Available machinists are used to clean, flush and examine the roller bearings. The front-end main rod lateral is checked with a small gauge similar to a surface gauge after the rod is barred over to both limits of its lateral travel.

Questions and Answers On Locomotive Practice

By George M. Davies

(This column will answer the questions of our readers on any phase of locomotive construction, shop repairs, or terminal handling, except those pertaining to the boiler. Questions should bear the name and address of the writer, whose identity will not be disclosed without permission to do so.)

Weight on Drivers

Q.—On a steam locomotive, what determines the percentage of the total weight on the driving wheels that is to be carried by each pair of wheels? Why does this weight vary on the different pairs of wheels?—R. E. T.

A.—As a general rule the weight on the driving wheels of a locomotive is distributed equally on the individual pairs of wheels, thus a 4-6-2 type locomotive having 201,000 pounds on the driving wheels would carry 67,000 pounds on each pair of wheels. This does not hold true for the weight carried by the springs resting on each pair of driving wheels due to the fact that the dead weights will vary with each pair of driving wheels because of the difference in the weights of the wheels, crank pin and driving boxes, etc., which make up the dead weights. The general practice is to vary the lengths of the spring rigging equalizer arms located between the driving wheels, so that the sprung weight carried by each pair of driving wheels will compensate for the amount that the dead weights vary and make the final distributed weight at the rail the same for all driving wheels.

Minimum Vision

Q.—On a modern steam locomotive used in passenger service and where the cab is located at the back of the boiler, how far ahead of the locomotive are the rails, outside the engineman's vision?—F. F. J.

A.—The illustration shows the conditions as found on a modern passenger locomotive. Looking down at the rails, the line of vision would be from the clear-vision window to the front edge of the runboards, or a vertical distance of 12 + 22, or 34 inches, for a longitudinal distance of 50 feet ahead of the clear vision window. With the clear-vision window 128 + 12, or 140 inches above the rail, the line of vision would strike the rail as determined by the ratio:

$$50:34:X:140$$

$$X=\frac{50 \times 140}{34}=205 \text{ ft. ahead of the clear vision window}$$

or

$$205-50=155 \text{ ft. ahead of the locomotive.}$$

Looking in towards the center of the rails, the line of vision would be from the outside of the clear-vision of the runboards, or a distance of 58 in. — 49 in. = 9 in. for a distance of 50 ft. ahead of the clear vision window. With the clear-vision window 58 in. — 30 in., or 28 in. outside of the outside rail, the line of vision would cross the outside rail:

$$50:9:X:28$$

$$X=\frac{50 \times 28}{9}=155 \text{ ft. ahead of the clear-vision window}$$

or

$$155-50=105 \text{ ft. ahead of the locomotive.}$$

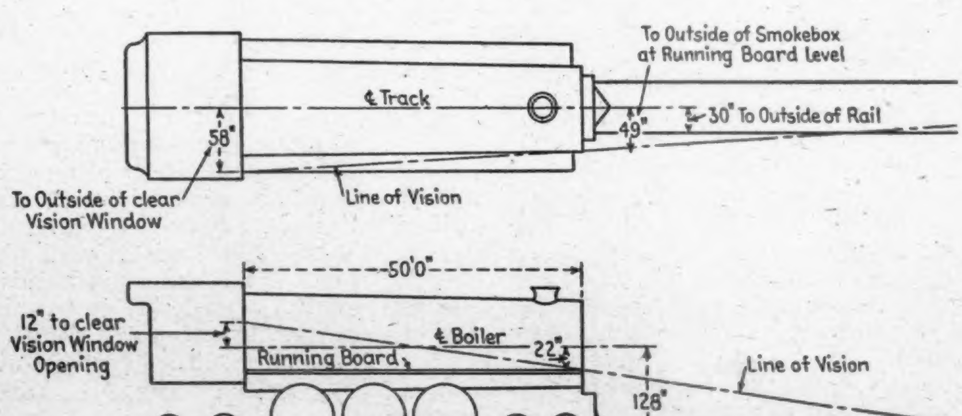
The engineer's vision of the rail is limited by the front edge of the runboard and the outside rail would be out of the engineman's vision for a distance of 155 feet ahead of the locomotive.

Gauge-Testing Bench

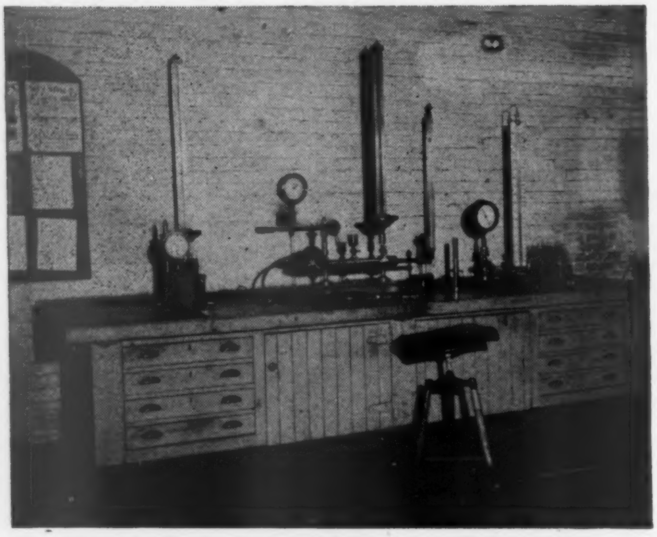
The apparatus for checking gauges at the Reading, Pa., shops of the Reading consists of a large bench on which are mounted mercury columns and test gauges along with the necessary tubing, cocks, and other apparatus for mounting and checking the accuracy of service gauges. Four testing points are used for checking hydraulic machinery gauges, general-purpose gauges, tank water-level indicators and vacuum gauges.

For testing hydraulic machinery gauges there is a 10,000-lb. per sq. in. gauge and a 4,000-lb. per sq. in. mercury column. The gauge and the column are interconnected with copper tubing to provide a double check on the accuracy of the gauge being tested. The necessary test pressure is obtained with a pump made from one feed of a force-feed lubricator and driven by a hand-operated crank with a 1 : 3 gear ratio for easier turning.

The assembly for testing steam and general-purpose gauges is similarly arranged. A 300-lb. per sq. in. test gauge is connected to a 500-lb. per sq. in. mercury column and the two readings compared to that of the gauge being



The ranges of visibility on a locomotive



The test bench for gauges—From left to right are shown the apparatus for checking hydraulic machinery gauges, general-purpose gauges, tank water-level indicators and vacuum gauges

checked. Pressure is applied by turning a crank which moves a piston through a screw arrangement. The movement of the piston in the cylinder tends to compress the water within the cylinder into the tube and piping, thereby generating the pressure necessary for causing the gauges and column to register.

Tank water level indicators are checked with a mercury column which is graduated in feet of water up to 33 ft. Pressure is applied to the column of mercury by an atomizer. The compressed air is pumped through a bicycle valve and copper tubing to the base of the mercury column. At this point the pressure is retained until the column is read, after which it is relieved by a separate needle valve.

Vacuum gauges are compared with a mercury column and a test gauge, both of which will register a vacuum up to 30 inches of mercury. The intake side of a bicycle pump creates a vacuum simultaneously on the gauge and the column and retains it until released by a wheel valve.

Air Brake Questions and Answers

The 24 RL Brake Equipment for Diesel-Electric Locomotives—Parts of the Equipment—Locomotive A Unit

535—Q.—What are the functions of this cock? A.—To cut out the automatic brake valve and safety control functions on the trailing locomotive when more than one locomotive is used.

536—Q.—Describe the closed position of this cut out cock. A.—In the closed position of the double heading cock, the automatic brake valve is cut off from the brake pipe preventing an automatic brake application, and the brake application piston *112* (Section *C-C*) is cut off from the safety control devices so that the safety control features do not function. Thus the control of brake operation is transferred from the non-controlling to the locomotive controlling unit on which the double heading cock is open.

537—Q.—With what special feature is the double heading cut-out cock handle provided? A.—The double-heading cock is so designed that it cannot be moved from the closed to the open position without a pause in mid-position. The cock handle *36* is provided with a spring latch *37* which engages a lug when turning, requiring that the handle be pulled to compress spring *38* in order to clear the lug before completing the handle movement.

538—Q.—Why is this pause provided? A.—This provides a short pause when cutting in the valve and avoids a quick reduction in pressure in the chamber on top of application piston *112* which would cause the higher air pressure below the application piston to move the piston and application valve *114* and cause a brake application.

539—Q.—Describe the positions of the double heading cut-out cock handle. A.—The cock is open with the handle down (horizontal position) and closed with the handle up (vertical position).

Locomotive Upkeep Requires Skilled Work*

By W. A. Paxton

When I began working as a mechanic, 35 years ago, we operated small balanced valves, Stephenson valve gear, Westinghouse air pumps on passenger locomotives, No. 2 New York pump on freight power, G6, B1, B2 brake valves and old plain triple valves, hydrostatic lubricators, with no guards around the lubricators and water glasses.

As shippers demanded the movement of more freight and faster service, larger freight cars were built. It was necessary to develop larger locomotives, both passenger and freight. The new locomotives were superheated, equipped with Baker or Walschaert valve gear, firedoor openers, Raggonet reverse gears, LT and ET Brakes, and later stokers were applied. The old kerosene and acetylene headlights also gave away to electric.

As the locomotives were improved, methods of doing repairs were improved. Welding frames by blacksmiths was replaced by Thermit, then oxyacetylene and now electric.

New Equipment Necessitates New Training

As new equipment was added to locomotives, it became necessary to train mechanics to maintain this added equipment. The locomotive inspection law had been passed shortly before I began service on the railroad. It has been amended five times since, and makes it more necessary that supervisors check inspectors to know that they are familiar with the law and that they know what constitutes a defect.

To repair a locomotive properly on its arrival after being coaled, it should be placed on the wash rack and thoroughly washed off, and have the boiler water tested as per instructions to determine the total dissolved solids on arrival so the locomotive boiler can be blown out as indicated by the test. The inspector should make daily test and check the locomotives for other defects, known as outside inspection, and then finish inspection after the locomotive is placed in the enginehouse or on the inspection pit.

When the fire is knocked, pitmen should be instructed to notify the foreman if there is anything wrong with the grates, steam leaks, or anything that should be taken care of that has to do with knocking fires, or herding locomotives. The locomotive after being taken care of at

* Excerpts from a paper delivered before the Illinois Division Supervisors Club of the Illinois Central at Champaign, Ill., and printed in the February, 1947, I. C. Magazine. Mr. Paxton is general foreman of the I. C. at Mattoon, Ill.

the pit should be placed in the enginehouse with the throttle shut off, cylinder cocks open, reverse gear on center, and all air-brake equipment drained and drain cocks left open on all equipment and main wheels chained or blocked.

Stokers, grates and ash pans are of prime importance in the availability program of preparing locomotives for service. Boiler inspectors should inspect all of these before the locomotive is dispatched.

No mechanic should be expected to repair locomotives unless the supervisor knows that he is familiar with what he is assigned to do, especially work done on appurtenances while the locomotive is under steam. It is the duty of the foreman to see that work reports are rendered on all locomotives and he should see as nearly as possible all jobs done and make frequent checks to know that when he signs the No. 1443 form, all work reported is repaired, or some disposition made of it. I have found that the inspector or mechanic will do his work right if the foreman is interested enough to work with him, so he knows what is wanted.

Good housekeeping and good safe tools for men to work with go a long way toward keeping everybody in a good frame of mind. The use of portable cranes and hoists will expedite the work.

The proper washing of boilers and cleaning of tanks, blowing flues, and making all other tests and repairs that should be done on monthly, quarterly and annual inspection, will go a long way in keeping locomotives in service. I am of the opinion, from past experience, that keeping power up in good condition is much cheaper in the long run. This can be decided by detail cost studies. *All jobs should be done as though they had a price tag on them.* If this were practiced, it would lead to a saving in maintenance cost and locomotive handling. It is worthwhile pointing out the effect of periodic inspection on repair cost per mile. Periodic inspections are performed on the basis of time and not mileage, therefore, the greater the mileage that can be performed by a locomotive between these inspections, the less they will cost per locomotive mile simply because there are more miles over which to divide the expense of such inspections.

Lubrication Prevents Trouble

Safety should always enter into every class of repairs and all employees should be instructed to work safely and keep safety a live subject. Nowhere is it possible to save more out-of-service time than in discovering poor lubrication before serious trouble is encountered. A great deal of help in this may be had from enginemen's reports and oral reports from crews. Much can be gained if supervisors will meet locomotives on arrival and talk to enginemen and look at locomotives to see how they are lubricating before being moved to the wash rack.

A supervisor should carry a book record of the different things that he sees or has had called to his attention, and what he intends to do.

Some locomotives have a tendency to run out of square, and cut tires badly. These will require special study since each is a special case. If this tendency can be eliminated, many out-of-service hours will be saved. The above trouble may be caused by engine out of tram, or tires turned smaller on one side of the locomotive, locomotive allowed to run out of level, or spring rigging not properly balanced. Every locomotive, or any other machinery for that matter, begins to wear as soon as it begins to move. The two great factors in preventing wear are correct adjustment and good lubrication. Most bearings fail because they have been allowed to accumulate excessive wear which causes heavy pound. This leads to failure on all working parts of the locomotive. As with tires, the larger the flat spot, the more rapidly it becomes worse.

Supply service is of great importance in cutting down the locomotive out-of-service time, and should be made a live subject of study by the mechanical department in conjunction with the supply department. We should not overlook the stock room and carry a lot of material that may never be used. Locomotives are expensive machines and they must have parts protection if they are kept in service.

Sanders should be kept in workable condition at all times, for sand on one side and none on the other causes excessive strain on one side fo the locomotive. Sanders not working cause slipping and hill doubling in many cases. They put extra miles on locomotives.

Master mechanics, traveling engineers and fuel supervisors can be of great assistance in instructing enginemen in proper firing and in bringing locomotives to terminals with the best possible fires. This will prevent the burning out of grates and ash pans, and time wasted in knocking fires.

The proper testing of superheater units and repairing leaks, keeping nozzle and bridge, as per instructions, is a large factor in keeping locomotives in service.

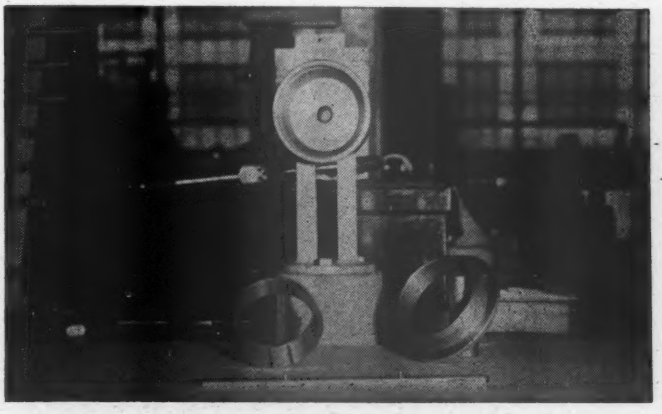
The adjustment of driving-box wedges, as per instructions, will add many miles to locomotives and save repairs to driving boxes and rods. Keeping valves square and cylinder packing and valve packing in good condition is a large factor in saving fuel and giving added efficiency to locomotives.

A mechanic who can keep spring rigging level and free from interference is indeed a valuable asset to locomotive maintenance and good riding.

Exchange of information and cooperation between the supervisors at different terminals, through which the locomotive operates, is helpful. Many small delays thus can be forestalled and we must not forget the tendency of small ones to become larger as the miles roll by and accumulate on the locomotive.

One-Piece Flexible Chuck

Honing or machining of Super Governor piston bushings to a true inside circular contour is made possible by the use of a one-piece chuck developed at the Reading, Pa., shops of the Reading. Bushings may be gripped in this chuck without the distortion that often results from clamping by a conventional three- or four-jaw chuck.



The one-piece flexible chuck shown with the holding piece and the honing stand

The chuck is made from a solid piece of steel. The inside surface is of true cylindrical shape and not tapered. The exterior is tapered to mate with the holding piece used in conjunction with this chuck. The chuck is splined to attain flexibility, and carefully machined all over to precision tolerances to give a snug fit between it and the bushing and between it and the holding piece.

To hone the governor bushings they are first placed inside the one-piece flexible chuck. The holding piece is placed over the chuck and the combined assembly of the holding piece, chuck, and the bushing is placed within the circular holding portion of the stand. The holding piece is inserted into this circular portion of the stand a sufficient distance to enable the chuck to grip the bushing firmly. In this position the bushing is honed with a tap wrench into which is inserted the honing member with a friction surface.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Lining Up Shell Courses

Q.—We are getting some new shell courses which are to be fitted up to the old firebox section. These courses come riveted together, and we have to rivet the connection to the firebox. Will you please tell me the accepted standard practice in aligning the barrel with the firebox section?—R. M.

A.—If the firebox has a sloping bottom the firebox ring is blocked up on the floor in approximately the correct sloped position. If the outside throat sheet has not already been fastened to the firebox, it should be applied to the back course with temporary bolts. A lifting chain is next placed around the shell course, a little ahead of the center of gravity, to allow the back end to dip down slightly. The shell is raised to a level which will permit the top of the back course to come on the inside of the wrapper sheet when slowly moved to the firebox.

The two top rivet holes in the front row of the back seam of the back course have been drilled. When these rivet holes come in line with the two corresponding rivet holes in the wrapper sheet, drift pins are slipped into the holes. The front end of the shell is then gently lowered while the throat sheet is worked within the wrapper sheet with pinch bars. A few drift pins are driven through the shell and back flange and the firebox-ring rivet holes of the throat sheet, after which bolts are applied to hold the assembly in place.

If the outside throat sheet has already been secured to the firebox, the procedure would be the same except that the back course would have to be fitted into the wrapper and throat sheets. The precedure is simplified if the latter is assembled as part of the shell course.

The boiler as assembled is now blocked up on the floor, leveled and checked for height and length. This work consists of fastening a line to an adjustable support. The support is bolted in the center of the bottom part of the backhead sheet and extends below the back end to depth which is below the bottom of the front end of the firebox ring or ring lug and then fastened to a floor stand beyond the front end of the smokebox. A plumb line is dropped from the back center firebox ring rivet hole, and one from the top center of the front face of the smokebox ring. The longitudinal line is then moved to touch the plumb lines. A plumb line is also thrown over the first course. The alignment of the boiler is then checked to the longitudinal line by checking the distance on either side of the line to the plumb line thrown over the first course, and also by checking the distance on each side of the line to the outside of the front of the firebox ring. These distances should be equal and the four points in line on the boiler.

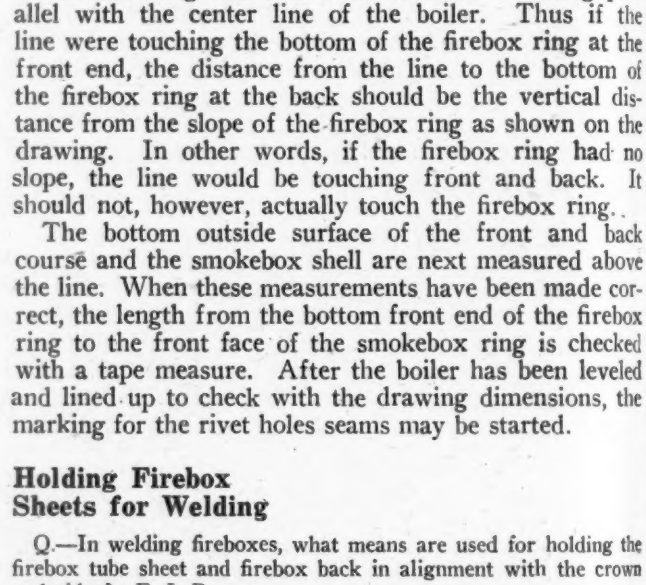
The longitudinal line is also set so that a vertical dimension from the line up to the front and back of the firebox ring indicates that the line is running parallel with the center line of the boiler. Thus if the line were touching the bottom of the firebox ring at the front end, the distance from the line to the bottom of the firebox ring at the back should be the vertical distance from the slope of the firebox ring as shown on the drawing. In other words, if the firebox ring had no slope, the line would be touching front and back. It should not, however, actually touch the firebox ring.

The bottom outside surface of the front and back course and the smokebox shell are next measured above the line. When these measurements have been made correct, the length from the bottom front end of the firebox ring to the front face of the smokebox ring is checked with a tape measure. After the boiler has been leveled and lined up to check with the drawing dimensions, the marking for the rivet holes seams may be started.

Holding Firebox Sheets for Welding

Q.—In welding fireboxes, what means are used for holding the firebox tube sheet and firebox back in alignment with the crown and sides?—F. I. B.

A.—The firebox tube and back sheets are bolted in place to the firebox ring after the firebox crown and side sheets have been set in place. The flange on the



Method of holding the firebox tube sheet and back sheet in place for welding fireboxes — Upper drawing illustrates an outside jig; lower, an inside jig

firebox tube and back sheets are lined up with the crown and side sheets as illustrated. Inside and outside jigs are used alternately as required, to line up the plates. The sheets are then tack welded at intervals before removing the jigs.

ELECTRICAL SECTION

Electrical Design for

Reduced Diesel Maintenance*

By A. H. Candee†

Best means of reducing electrical repair cost on Diesels are apparatus of adequate capacity, strict adherence to tonnage ratings and limited amount of standardization

(RAILROAD officers having extensive experience in the operation and maintenance of Diesel-electric locomotives offered their opinions on how locomotives should be designed for reduced maintenance at the annual meeting of the A. S. M. E. Railroad Division held in New York, December, 1946. Their comments were broken down into four main subdivisions covering Diesel engines, electrical equipment, chassis and accessories.

Manufacturers were given an opportunity to reply to these suggestions at the semi-annual meeting of the society held in Chicago, June 15-19, 1947. Representatives of five manufacturers participated with four papers as follows: a paper on electrical design, by A. H. Candee, transportation engineer, Westinghouse Electric Corporation; a paper by Dana R. Staples, The Baldwin Locomotive Works; a paper by L. E. Endsley, consulting engineer, and W. W. Schettler, chief engineer, Fairbanks, Morse & Co.; a joint paper by J. W. Teker and M. D. Henshaw, General Electric Company, and John Seagren and S. B. Paul, American Locomotive Company. An abstract of Mr. Candee's paper follows. The others will be published in subsequent issues of *Railway Mechanical Engineer.*)

Progress in the design of Diesel locomotives and their equipment is the result of a coordination of ideas by the designers and the railroad men who operate and maintain the locomotives. While the designers are usually in touch with technical developments and are ever alert to apply these to improve their products, no one sees the need for improvements better than those who are responsible for the continued operation of the locomotives and for keeping the operating and repair costs to a minimum. For this reason, we of the electrical industry have given serious thought to the suggestions made at the ASME forum on "Diesel Locomotive Design for Reduced Maintenance," on December 4, 1946, at New York by five outstanding Diesel locomotive operating men, as to ways and means of improving the reliability of Diesel motive power and of reducing repair costs.

A review of the suggestions which pertain to improved operation and reduced maintenance shows a wide variety of places where electrical improvement is needed. Many of these cover the method of installing electrical equipment while others concern the fundamental design of the equipment itself. There should be little difficulty in embodying some of the minor suggestions in current production lines, such as tagging wires and cables to agree with diagrams, stenciling control apparatus for easy identification, and similar proposals. Other suggestions are more difficult of accomplishment, since they require coordination between manufacturers or major changes in equipment design.

A summary of the suggestions made by five railroad officers concerned with the maintenance and operation of Diesel-electric locomotives at the A. S. M. E. forum follows:

W. C. Marshall, assistant superintendent motive power Diesel operation, Chicago, Milwaukee, St. Paul & Pacific:

Standardization will improve repair economy.
Improve designs and apparatus locations.
Tag all wires and cables to agree with diagram.
Locate wiring and conduit in accessible places.
Allow extra wires in cables or conduits.
Use Nofuse "De-ion" breakers instead of fuses.
Stencil all control circuit apparatus for easy identification.
Locate equipment for improved accessibility.
Use 32-cell batteries for control purposes—3 sizes.
Improve and standardize battery compartments.
Standardize traction motor designs—
Or each manufacturer use but one size.
Possibly railroads should draw up standard spec.
Oil lubrication of ball and roller bearings.

J. P. Morris, general assistant, mechanical, Atchison, Topeka & Santa Fe:

Decrease the cost of repair materials.
Standardize equipment.
Build in ample reserve capacity.
Oil lubrication of traction motor armature bearings.
Felt wick packing for traction motor axle bearings.
Greater dependability of traction motors and generators.
Enclose relays to exclude dirt and dust.
Improve brush life for motors and generators.
Temperature protective device for motors and generators.
Automatic transition-series to parallel or vice versa.
Improve accessibility at fan end of generator.
Selection of wheel diameter to reduce rail stresses.
Increase dynamic-braking capacity.

M. C. Sharp, superintendent automotive equipment, Chicago, Rock Island & Pacific:

Improve equipment ventilation.
Greater control equipment accessibility.

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* Paper presented at the semi-annual meeting of the American Society of Mechanical Engineers, held in Chicago, June 17, 1947.
† Transportation Engineer, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Use heat-resisting piston packing instead of leather.
Drive air compressors by electric motors.

F. Thomas, assistant to general superintendent motive power, New York Central:

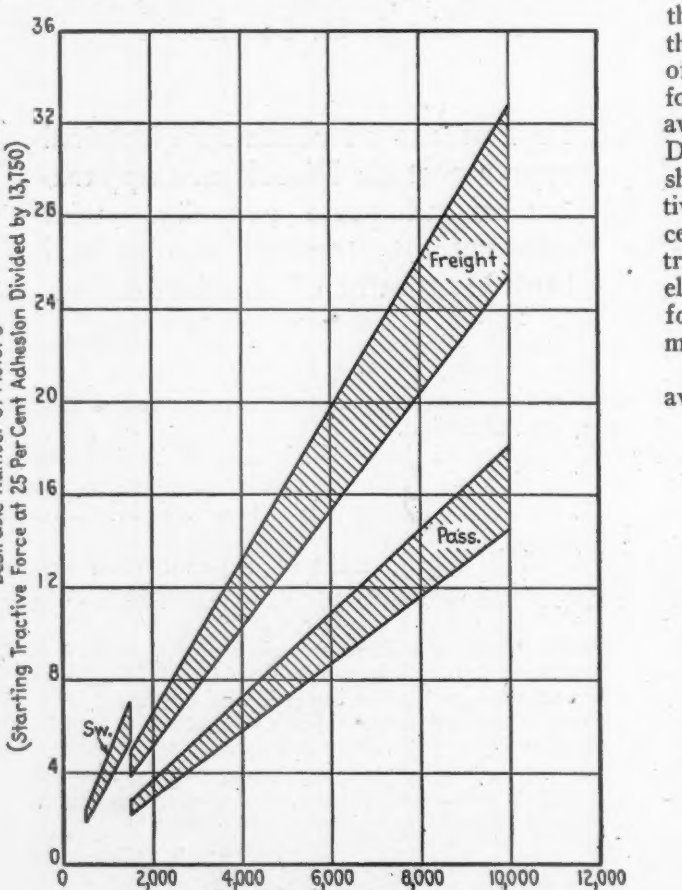
Standardize electric jumpers and receptacles.
Provide multiple control between all locomotive types.

G. F. Wiles, supervisor Diesel-electric locomotive operation, Baltimore & Ohio:

Cables and conduits to be located overhead.
Provide protection against locomotive interior spray cleaning.
Shield traction motor vents against spray cleaning of trucks.

Two Major Suggestions Emerge

The list of improvements shows a wide diversity of thought as to what is needed to improve locomotive operations, reduce road failures, and cut maintenance ex-



Desirable number of motors for best starting and low electrical maintenance, based upon 55,000 lb. axle load and 25 per cent adhesion—Desirable starting force of 50-65 lb. per hp. for switching, 20-25 lb. per hp. for passenger, and 35-45 lb. per hp. for freight locomotives

pense. It is our opinion that, while many of these improvements are desirable, their effect in reducing maintenance costs is of a minor nature. However, two of the suggestions appear to be of major importance and were brought out by at least two of the December papers. These were: (1) Increased electrical capacity, and (2) standardization of equipment. While the Westinghouse Electric Corporation has always advocated ample electrical capacity as a means of reducing road failures and electrical repair expense and is receptive toward standardization between manufacturers, we believe that one suggestion—that each manufacturer use but one size of traction motor—does not contribute to good engineering or railroading. Many road failures and high electrical maintenance expense may result with such standardization if this single motor type does not have adequate capacity for all services, as experience with "standardized" motors has shown. Lower costs will result from the use of two or even three motor types, each of adequate capacity for the service to which the locomotives are applied, since this should materially reduce the number of failures.

Some Items More Important Than Others

While many of the sugestions set forth at the forum are pertinent and will undoubtedly save repair costs, we have elected to approach the question of reduced electrical repair expense in a somewhat different way, based upon an analysis of the expenditures actually being made for different operations comprising total electrical maintenance. In response to our inquiries, a number of railroad Diesel officers have been very helpful by taking the time and trouble to give us their judgments as to the division of electrical expenses for the different phases of electrical maintenance. While these varied slightly for different railroads, we have been able to establish fair averages. From these data, it appears that with the Diesel motive power now in use, electrical repair expense should average less than 25 per cent of the total locomotive repair expense. One railroad, which has had excellent maintenance results, estimates even lower electrical costs. For Diesel switchers they estimate that electrical repairs are 20 per cent of the total repair costs; for freight work 17.7 per cent; and for passenger locomotives 15.7 per cent.

Of the total expense for electrical maintenance, the average estimated expenses may be divided as follows:

Maintenance operation	Per cent of total electrical expense
Inspection and cleaning-rotating equipment	15
Brush replacements	7
Lubrication of rotating equipment	3
Armature bearings	5
Armature rewinds	25
Replacing field coils	5
Dipping and baking	5
Axle bearings	2
Pinions and gears	5
Control maintenance	12
Batteries	6
Miscellaneous (unaccounted)	10
Total	100

Rotating Equipment Most Important

From the cost breakdown, it may be noted that armature rewinds, replacement of field coils, dipping and baking, and brush replacements account for approximately 42 per cent of the total cost. It is in the rotating equipment, then, that the greatest possibilities lie for the reduction of Diesel electrical equipment repair expense.

The life of rotating-apparatus insulation, the brush wear, and the probability of failure on the road are vitally dependent upon the electrical loads to which the equipment is subjected. While the electrical loading of Diesel locomotive equipment is always of a fluctuating character as a fluctuations, as well as the electrical temperatures which are reached on the long, heavy pulls, are the major factors which determine the life of insulation and repair costs of the rotating equipment.

Armatures are the greatest source of failures in the electrical rotating equipment. When short-time peak-current values are required for the purpose of negotiating an especially severe grade of short length, heat is generated within the armature coils which expands these

coils excessively with respect to the rest of the armature, causing relative movement and chafing of the coil insulation. Likewise, heat may be localized in such places as the commutator necks and may soften the solder. While these peak-current values may be within the calculated or tested short-time rating values, repeated applications of such heavy currents will eventually result in weakened insulation. Brush life is also affected by these short-time peak-current values. Furthermore, it has been established rather definitely that the life of Class B insulation is halved for each 10 degrees Centigrade increase in operating temperature. Thus, lower operating temperatures will have a decided effect in increasing insulation life, reducing road failures, and lowering repair expenses. It is known to be a fact that many of the road locomotives now in operation have inadequate ventilation (primarily due to slippage of fan drive belts) and that the ventilating air is far too hot. As an immediate measure of relief, it is suggested that steps be taken to improve both of these conditions.

Larger Equipment and Controlled Operation

It is our belief that the best way to accomplish a major decrease in electrical repair expense is to use electrical rotating equipment of ample capacity. As often stated, it is also our opinion that a great many of the traction motors and generators now owned and operated by the railroads of America are too small. We of Westinghouse have consistently promoted the use of larger capacity equipment and have suffered financially from this policy in the competitive market, yet we are continuing to advocate the use of this larger equipment since we believe it to be to the best interests of the railroads and the Diesel locomotive industry.

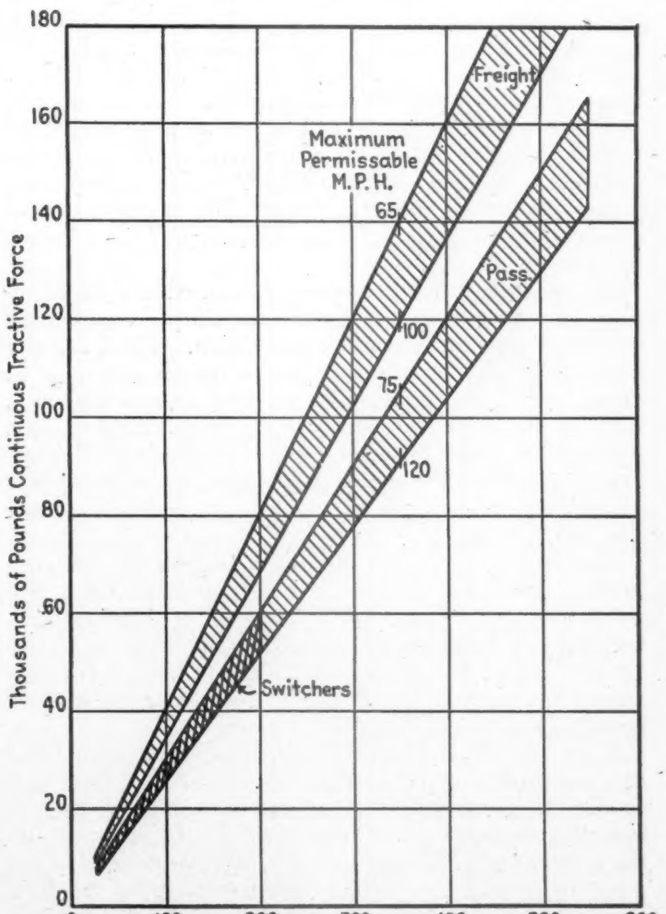
In addition to the use of electrical equipment of adequate capacity, it must be applied and used well within its temperature limits. To use such equipment on the basis of its short-time overload capacity is to invite higher electrical repair expense. One of the characteristics of such apparatus is that damage, which may be done, seldom shows immediately. A dispatcher may think that he is getting the most out of the locomotive by loading it to the limit; actually he is shortening life of equipment and contributing toward high-repair expense by so doing. There is also real danger of damage when the electrical equipment is utilized close to its thermal capacity on a short-time basis, since a reduction in engine power or loss of an engine will lengthen the overload duration beyond safe limits.

The use of electrical equipment within safe temperature values should prolong the life of insulation so that rewinds are unnecessary over a long period of years. Likewise dipping and baking should not be necessary at less than four-year intervals. It might be stated here that dipping and baking is not a panacea except for the renewal of surface coatings which have aged and for possible tightening of coils in the armature slots. It may actually be detrimental when the electrical windings are repeatedly coated with a varnish, since such coatings impede the dissipation of heat from the windings and thus act to raise electrical temperatures. Furthermore, dipping and baking can seldom repair insulation which has been chafed due to thermal expansions or has been physically damaged.

We suggest, therefore, that railroads who have high electrical repair expense should investigate their Diesel tonnage ratings with a view toward reducing electrical loads by lowering tonnages and thus improving repair costs.

Other Important Suggestions

Returning now to the breakdown of electrical repair expenses, the second largest expenditure is for control inspection and maintenance. This proportionate expense seems out of reason, because the control equipment involves no large or expensive items and its maintenance should be routine. In the interest of keeping the control equipment simple, we of Westinghouse have advocated permanent traction-motor connections to eliminate transitions with their resultant electrical complications and increase maintenance expense. We have also applied the Autoload system of engine load control. which is simple, yet extremely effective in accomplishing the basic results required for engine loading. Simplicity should be the keynote of all such control systems, and the introduction of complicated devices or those requiring delicate adjustments should be avoided if maintenance cost is to be kept to a minimum. We suggest that, in the interest of lower expenses, that the railroads should consolidate their thinking and insist on utmost simplification of control equipment. We also wish to emphasize that serious consideration should be given before insisting that locomotive units of different manufacturers be equipped for universal multiple control because, as now built, even the various types of locomotives of one manufacturer may not multiple with each other. Such requirements inevitably result in increased complication and maintenance expense and may restrict developments of improved and simplified control systems.



Estimate of desirable electrical continuous rating for Diesel locomotives—Curves show ratings for minimum repair expense—The farther the electrical ratings fall below these curves, the greater the risk of high electrical repair costs and the greater the need of careful application study

One item of repair expense which deserves some consideration is that of batteries. Following the suggestion made in New York on December 4, 1946, one manufacturer has laid plans to change from a 125-volt system to a 70-volt system for the sake of battery standardization. This is a definite step in the right direction.

It was suggested in New York that oil lubrication of traction motor armature bearings and main generator bearings be applied. This question is being given close consideration. While it may be true that oil provides better lubrication than grease, it is also conducive to higher cost because bearings must be lubricated much more frequently than with grease. Furthermore, care must be taken to prevent dirt entering the housing, and to retain the oil lubricant. From the breakdown of electrical maintenance expenses, where lubrication is shown as three per cent and bearings as five per cent, these proportions might easily be reversed with oil lubrications, with no net saving in total costs. The service performance of oil lubricated bearings is being watched with a great deal of interest.

Electrical Capacity Analyzed

In discussing the desirability of increased electrical transmission capacities for Diesel locomotives, no mention has as yet been made of the actual values required for minimizing road failures and reducing repair expense. In order to place quantitive figures on the most suitable characteristics and capacities needed, an analysis has been made, based upon experience gained thus far in the operation of this type of equipment on the railroads. This analysis shows that one of the most desirable characteristics of Diesel motive power is its ability to start heavy trains smoothly by "leaning" against the train rather than by taking slack. This characteristic should be retained, and leads to a definition of starting tractive values based upon observations: yard switching, 50 to 65 lb. per Diesel engine horsepower; passenger service, 20 to 25 lb. per Diesel engine horsepower; freight service, 35 to 45 lb. per Diesel engine horsepower.

In figuring starting tractive forces, values of adhesion between wheels and rails above 25 per cent cannot be expected as an all-weather condition. Thus, for any given axle loading, the number of driven axles, or in other words, the number of traction motors required, may be determined. See curve A for a 55,000 lb. axle loading. It must be remembered, however, that Diesel-locomotive electrical equipment cannot be economically designed to safely haul continuously the maximum loads that can be started.

Experience is the best guide for determining the continuous tractive-force rating (fixed by electrical equipment heating) of switching locomotives. It has been found that if this continuous rating falls between 13 and 15 per cent of the weight on drivers (13 to 15 per cent adhesion), such a locomotive is seldom overheated in normal yard or short transfer service.

Passenger service normally involves the maintenance of train speeds at relatively high levels. To meet this condition, locomotives are seldom loaded to operate at less than 30 per cent of maximum permissible speed on the limiting grades. Thus, for a locomotive geared for a top speed of 75 m. p. h. the minimum speed at which it may be expected to operate is around 20 to 25.5 m. p. h. Since the effective adhesive factor at this speed approximates 15 per cent for wet rail conditions, a continuous electrical rating at this adhesive value (upon which maximum tonnage ratings would normally be based) should make such a locomotive nearly self-protecting. However, with these same motors and with the locomotive geared for higher permissible speeds, the continuous electrical rating is reduced in inverse proportion to the increase in permissible speed and, even though the adhesive values decrease slightly as speeds increase, it requires more care in fixing tonnage ratings to prevent overloading.

Freight Locomotive Rating

Of the three classes of service, the electrical rating of freight locomotives is of the greatest importance, since tonnage loadings may vary widely and are controlled by yardmasters or dispatchers who may not realize the necessity of limiting tonnages if low repair costs and reduced road failures are to be attained. Where, with steam locomotive operations, it has been the practice to load a locomotive nearly to the stalling point on the ruling grade, this cannot be done with Diesels. The operating officers must establish fixed tonnages and have the personnel adhere rigidly to such loadings, even though weather or rail conditions might appear to permit of greater tonnages. However, in negotiating the severe grades, it is reasonable to expect the Diesel to pull down to speeds as low as 15 per cent of its maximum permissible speed in the interest of obtaining practical utilization of the locomotive, and the electrical equipment should be built to permit this. With a 65 m. p. h. gearing, this speed might be somewhere around 10 m. p. h. on the limiting grade. Since the normal wet-rail adhesive value approximates 20 per cent at this speed, the continuous electrical tractive force rating for low-cost electrical repair expense should be somewhere in that neighborhood. As with passenger locomotives, when this same locomotive and electrical transmission equipment is geared for higher top speeds, the continuous electrical rating is reduced correspondingly and greater care must be exercised in establishing safe tonnage ratings. Curve B shows the preferred electrical capacities for switching, passenger, and freight Diesel locomotives, limiting lines of each band being based on maximum adhesive values expected when geared for the maximum speed shown.

High electrical repair expense frequently results from continuous operation at or near the maximum permissible locomotive speed established by the manufacturers. Unless the commutators are true and smooth, brushes do not always follow the surface of the commutators at high speeds with the result that surfaces roughen and brushes wear faster than normal. Flashing may also result, with expensive consequences. This condition is somewhat aggravated by loose definition of the term "maximum permissible speed." From the standpoint of motor rotational speeds, the difference is about 8 per cent between new and worn wheels. Maximum permissible speeds should be based on maximum motor speeds with the motors geared to worn wheels, and gearing should be applied to leave a 10 per cent leeway above maximum train speed. Some manufacturers use new wheel diameters as the basis for this figure, resulting in overspeed of the motors if operated at this speed when the wheels are worn.

We are of the opinion that much can be done to reduce Diesel locomotive repair expense and will cooperate to the best of our ability in accomplishing this end from the standpoint of the electrical apparatus. However, each locomotive builder and equipment manufacturer has his own methods of production and standards which cannot be readily changed. Moreover, they all face the problem of severe competition and the neces-

(Continued on page 379)

Passenger-Car Auxiliary Power*

By D. R. MacLeod and Jack Hause†

Axle-driven motor-generators, engine-driven generators, d. c. to d. c. boosters, amplidyne-booster, vibrating-reed and variable-frequency inverters for meeting the power requirements of railway passenger cars

THE paper was written to outline some of the principles which have governed the development of electrical equipment for railroad passenger cars, and to discuss developments which may prove of advantage to the railroads. The following abstract includes only that part of the paper which has to do with equipment developed recently by the General Electric Company. (Editor)

The motor-generator sets for 32, 64 and 114-volt d.c. batteries, manufactured by the company with which the writers are associated, all have the same outline dimensions and approximately the same weight (see Fig. 1). They are two bearing machines for suspension by bonded rubber-resilient mountings beneath the car body. The machines are self-ventilated with fan mounted on the armature shaft. Baffle type air cleaning is provided in the air entrance passages at both a.c. and d.c. ends of the machine. Many of the parts such as brush holders, etc., are interchangeable on the four different machines. The following tabulation gives some of the pertinent data for these motor-generator sets:

Nominal battery voltage, d.c.	32	64	64	114
Regulated charging voltage, d.c.	37.5	75	75	134
Kilowatts	20/25	20/25	30/35	25/30
Maximum output (lead battery) kw.	28.5	29	40	33.5
No load (85 per cent normal volts) cut-in	520	520	690	590
Full load (100 per cent volts) speed	690	690	915	780
Maximum speed	3780	3780	3780	2470
A.c. motor, hp.	25	25	25	25
D.c. output, on a.c. wayside power kw.	15.5	15.5	15.5	15.5

The control system for these motor-generator sets consists of a voltage control relay panel, generator control panel, Fig. 2, and a three-pole cross-the-line a.c. motor starter.

The voltage-control panel incorporates a contact-making electro-magnetically controlled relay with both voltage and current elements. The voltage element acts to maintain constant d.c. voltage output from the d.c. generator from full-load cut-in r.p.m. to the current-limit cut-in value of amperes load. At the point where current-limit cut-in value is reached the current element acts on the voltage-control relay to reduce the d.c. generator voltage while permitting the load current to increase. The slope of this voltage curve at the full-load cut-in speed is approximately 25 per cent increase in amperes for approximately 15 per cent reduction in voltage. The point where current-limit cut-in is reached increases in amperes load as the speed of the generator increases, thus taking advantage of the increasing rating of the self-ventilated machine at the higher speeds.

* Abstract of a paper presented at the summer meeting of the American Institute of Electrical Engineers held in Montreal, Que., Canada, June 9-13, 1947.

† The authors are application engineers, Transportation Department, General Electric Company, Erie, Pa.

The 32-volt 20/25-kw. motor-generator battery charging characteristic when operated with voltage control relay is shown in Figs. 3 and 4.

The generator-control panel mounts the reverse-current relay, the line contactor, the load-limit shunt and relay, and main fuse or overload relay. A voltage element is included with the reverse-current relay as a differential element to pick up the generator contactor when generator voltage exceeds battery voltage by approximately 2 volts. The generator contactor is opened again by the reverse-current element of the same relay with a reverse load-current of approximately 7 amp. The load limit shunt and relay act to change the current limit cut-in value to hold 15.5-kw. output of the d.c. generator at 1,750 r.p.m. when operating from 220-volt, 3 phase, 60 cycle wayside plug-in power from the 25-hp. induction motor. A relay is included to prevent load being applied to the motor-generator set until it comes up to normal operating speed when operating from wayside power.

The motor-generator has an armature reversing switch mounted on the commutator end of the set. The initial revolution of the motor-generator operates this armature-reversing switch to correct generator polarity for the direction of train travel. The generator builds up its terminal voltage as a self-excited machine.

In applying these axle-driven motor-generator sets for a particular run, it is necessary to consider not only the kw. rating but also the minimum full-load speed. The best generator for the job is the one that results in the least amp.-hr. discharge from the battery. Certain rail-

Fig. 1—Type GMG-150, A-C-D-C, motor-generator set

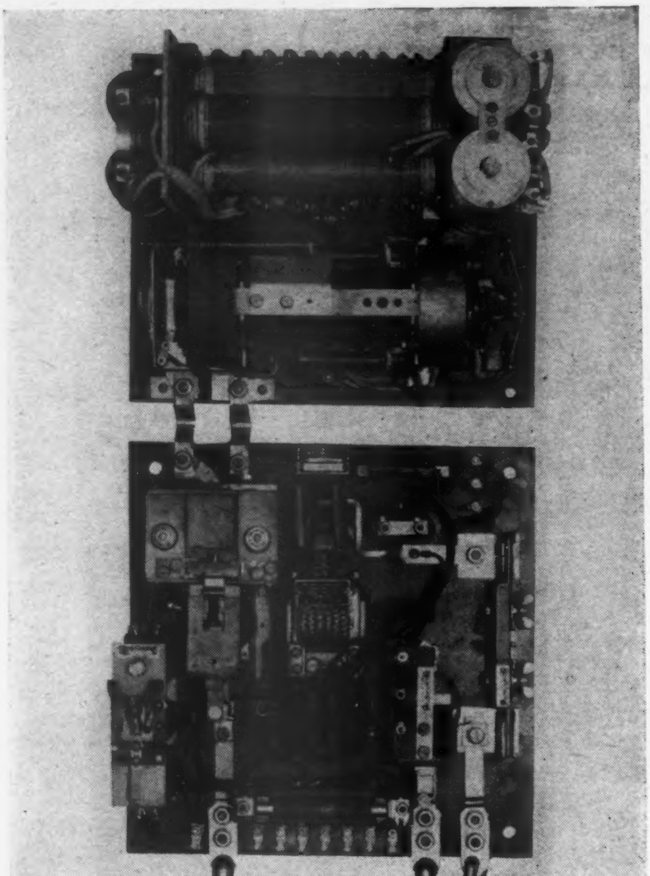


Fig. 2—Assembly of voltage control relay panel (upper) and generator control panel (lower)

roads have long runs involving mountain grades where speeds average 18 to 25 m.p.h. and also relatively long restricted speed approaches to route terminals. In these cases, low cut-in speed is more important than having a high kw. output from the generator. On the other hand, other railroads have runs where almost all of the traveling is done at relatively high speeds in which case a high kw. rating is more important than low cut-in speed.

As an example of the above, an application study was made of a run from Washington to St. Louis using the actual speed-distance curves and converting them into speed-time curves for calculating the amp.-hr. charge and discharge duty on the battery. The results of our computations are as follows:

	A	B
Generator capacity kw.	20/25	30/35
Full load cut-in speed r.p.m.	690	915
Amp.-hr. charge	2117	3820
Amp.-hr. discharge	696	1057
Amp.-hr. charge x 0.7	1482	2680

Note: Calculations from speed-time curves based on 17.8 kw. constant load 235 amp. at 75-volts charging and constant load 235 amp. at 64-volts discharging.

These data indicate that generator "A" will give a more satisfactory operation because of lighter-load duty on the battery even though the kw. rating of the generator is lower. This advantage of low cut-in speed of course becomes less important as the percentage of operation becomes predominately high speed.

A.C. Power Supply

The railroads have long realized the advantages of induction motors for use on passenger cars instead of commutator motors. This advantage of a.c. power has been more forcefully brought to their attention in recent years by other innovations such as fluorescent lighting, electric razors, radios, public address systems, sound movies, etc.

This requirement for a.c. power has led the railroads into many different methods of obtaining it, such as:

(a) Head-end power cars with engine-driven alternators and distribution lines to feed a.c. power back through the train.

(b) Engine-driven alternators mounted on individual cars.

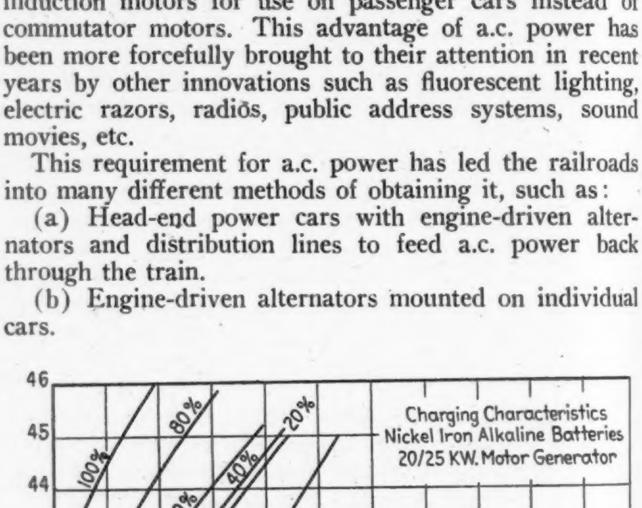


Fig. 4—Charging characteristics nickel-iron-alkaline battery 20/25 kw. motor generator

(c) Motor-alternator sets driven by d.c. motor from the battery.

(d) Vibrating-reed inverters operating from the battery.

(e) Amplidyne-booster inverters, or simple inverted-synchronous converters operating from the battery circuit.

An ideal system of power supply for the electrical loads on railroad passenger cars consists of a large engine-driven generator power plant consisting of two or more units at the head-end of a train. The operating disadvantages are principally those associated with an interchange of cars between different railroads and between different trains on the same railroad. The advantages and disadvantages of this system have been thoroughly discussed by J. D. Loftis.[1]

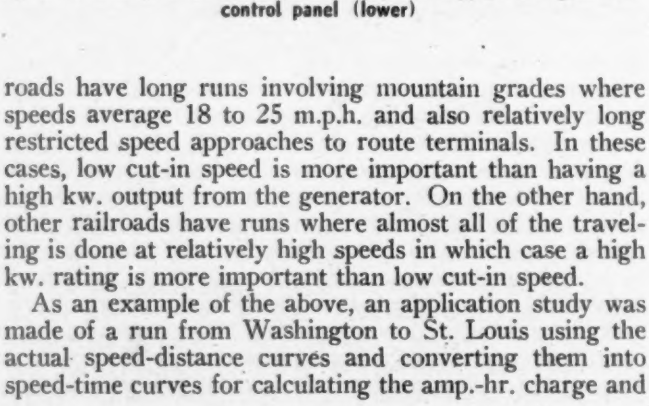


Fig. 3—Charging characteristics lead-acid batteries 20/25 kw. motor generator

[1] "The Case for Head End Train Power" by J. D. Loftis, *Railway Age*, February 1, 1947, pages 265-269.

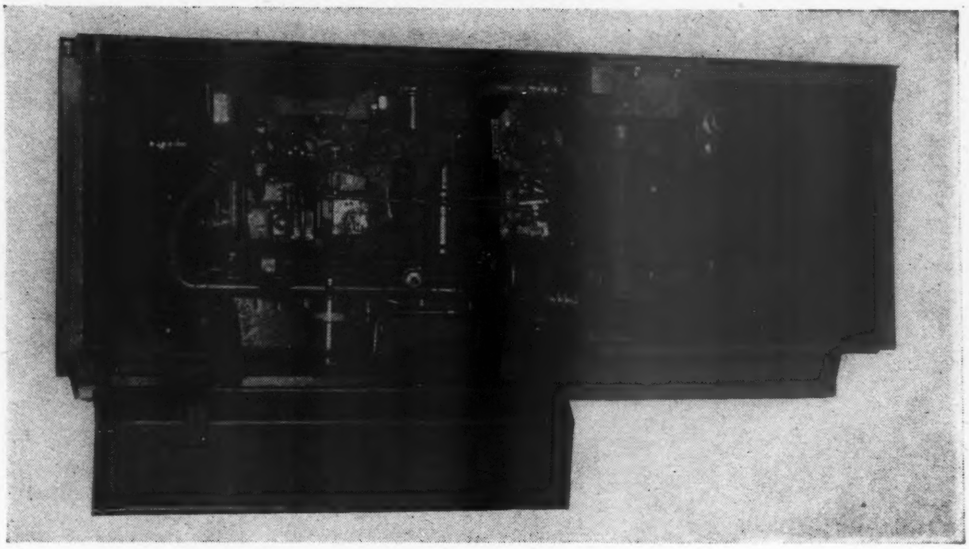


Fig. 5—Diesel engine driven 25 kw. alternator power unit for under car mounting

Engine-Driven Generators for Car-Mounting

Most railroads require that any passenger car be capable of carrying its air-conditioning load for at least two hours independent of any outside power source. Even where a.c. plug-in power is available in yards and terminals, there are other conditions which require a relatively large battery. These batteries must be charged at a relatively high rate, while the car is running, putting a heavy drag on the locomotive. For example, a 20-car train may require as much as 800 hp. from the locomotive for the electrical power taken by a car. This is an appreciable percentage of the locomotive rating for normal operation. On some railroads the variation in the number of cars that have to be hauled by the same locomotive in different trains may be so great that no credit can be given to a self-contained power plant for the saving in locomotive horsepower. On the other hand, where trains of the same length are hauled by the same locomotives day after day, the saving in locomotive horsepower can be credited to the self-contained power plant. In this case, an engine-driven power plant on each passenger car, with a relatively small battery for starting the engine and for emergency incandescent lighting, will be more economical than an axle-driven generator and large storage battery. The problem of noise, exhaust fumes and maintenance must be evaluated and these considerations may outweigh first cost advantages of the individual power plant.

A number of railroads have used two propane engines on each car for driving air-conditioning compressors directly and a small d.c. generator for the lighting, auxiliaries and charging a small battery.

In recent years, Diesel fuel has become available on a number of railroads and railroad shops have become proficient in maintaining this type of engine. The advantages of a.c. power for motors and fluorescent lighting have turned the attention of several railroads to Diesel engine-driven power plants that can be mounted under a car. Several manufacturers are developing Diesel engine-driven a.c. power plants for undercar mounting. Some consideration is also being given to engine-driven d.c. generators. Advances made during the last war in the design and building of reliable small engines and also advances made in the electrical field in design and construction of a.c. generators and the voltage-control components have made this possible. Figures 5 and 6 show pictures of a 25-kw., a.c., 230-volt, 3-phase, 60-cycle power plant for undercar mounting. Much attention has been given to accessibility of the power unit for maintenance.

There are several problems associated with the use of small engine-driven alternators on cars. First and foremost is the need for clean air for engine intake. If the air is taken from under the car, the filters are bulky and will require frequent cleaning. If taken from inside the car, a location must be found where the noise will not be objectionable. Since fluorescent lighting will usually be operated on the same bus as the air-conditioning compressor motors, the response of the engine governor and

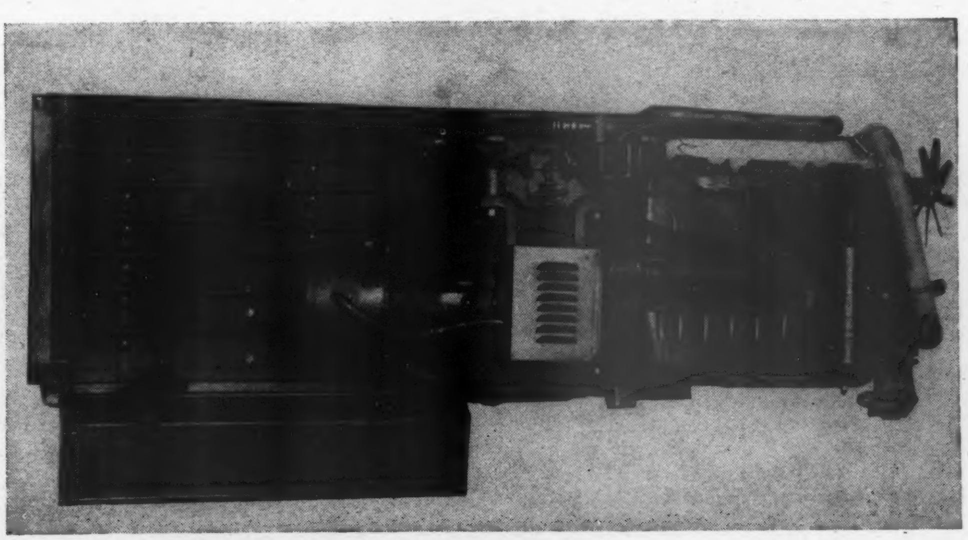


Fig. 6—Diesel engine driven 25-kw. alternator swung out 180 deg. for inspection or maintenance

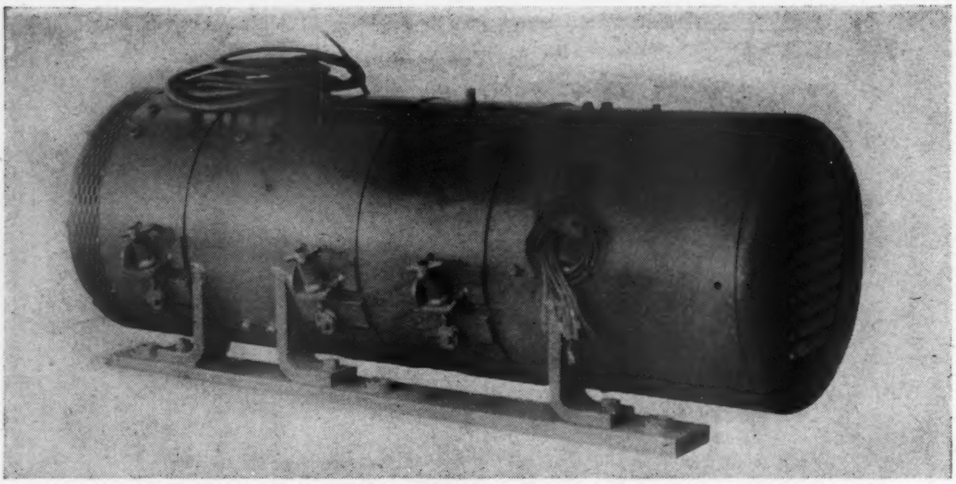


Fig. 7—Type 5LY153 amplidyne booster inverter for supplying 60-cycle, three-phase power for railroad passenger cars

the speed of the voltage regulator must be given careful consideration. Most small engines are usually supplied with mechanical governors which have relatively slow response to suddenly applied loads. On the other hand, the mechanical governor is less likely to hunt if the engine-driven generators are to be operated in parallel. It is desirable to use unloading valves on the compressor to reduce the high torque of the compressor when the start is made from an unfavorable position of the piston. A high-speed regulator is needed to reduce lamp-flicker of fluorescent lights due to the high starting current of induction motors.

Vibrating-Reed Inverters

These devices are used where small a.c. power outputs are required as for razor outlets on Pullman cars and coaches that do not have other sources of a.c. They have proved economical on applications where intermittent service is required. The modern type[2] is designed for ease in replacing parts that are subject to wear.

Amplidyne-Booster Inverters

The only practical method that has been developed of getting constant-voltage, constant-frequency a.c. power from the axle of a car is to generate d.c. by means of an axle-driven generator and then convert to alternating current. This double conversion means a serious loss in power and, therefore, it is important to use as efficient a conversion unit as possible. With existing air-conditioning systems, the advantage of driving the air-conditioning compressor with an a.c. motor has not justified the conversion of all the d.c. power to a.c. power.

The nearest combination to the all a.c. power car would be a car with a.c. power for motors, fluorescent lighting, radio and public address systems, electric razor outlets, etc., except the air-conditioning compressor motor and emergency lighting. This a.c. power can be supplied by one machine if that machine has voltage characteristics that will allow a 1-hp. induction motor to be started on the same a.c. power supply bus as the fluorescent lights. This has been done by supplying 5-kw., 6.25-kva. amplidyne-booster inverters. The principal electric loads on the car, except the 15-hp. air-conditioning compressor motor which is fed directly from the d.c. bus, are carried by the amplidyne-booster inverter. In the case of one railroad, this includes a 1-hp., 3-phase, 60-cycle condenser fan motor, a 1-hp., 3-phase, 60-cycle evaporator fan motor, two single-phase, ⅓-hp. exhaust fan motors, all fluorescent lighting, a single-phase drinking water cooler motor and other small a.c. loads.

The amplidyne-booster inverter supplies substantially constant 230-volt, 3-phase, 60-cycle power within the operating range of the axle-driven generator and storage battery. The equipment consists of an inverted converter in series with an amplidyne mounted on the same armature shaft and in the same frame, a static voltage-regulator of the saturable-reactor type, and a step-type d.c. motor-starting panel. Figures 7, 8 and 9 show pictures of the equipment. The amplidyne bucks or boosts the d.c. voltage from a medium value to maintain substantially constant a.c. voltage at the slip rings of the inverter. The frequency variation is between 58 and 62 cycles with d.c. battery voltages of 105 volts to 160 volts d.c. for 114-volt battery and corresponding d.c. voltages for a 64-volt battery. The control field of the amplidyne requires an output of approximately one watt from the static regulator and the response is practically instantaneous with suddenly-applied loads.[3]

The curves of Fig. 10 show the d.c. kw. input versus a.c. output at 80 per cent power factor of typical 6.25 kva. and 8 kva. a.c. amplidyne-booster inverters when operating on the battery. The efficiency will be higher at higher voltages. The 6.25-kva. machine is used on sleepers, parlor cars and coaches. The 8-kva. machine is for application on diners where additional a.c. power is required for food storage locker refrigeration.

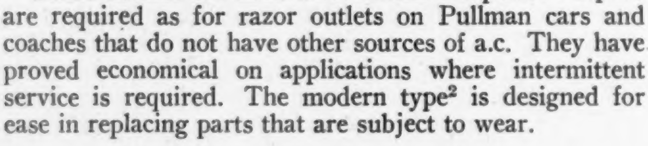


Fig. 8—Voltage-regulator panel, 3GNA13 for use with amplidyne booster inverter

[2] "New Type of D-c to A-c Vibrator Inverter," by O. Kiltie, A.I.E.E. Transactions, Volume 59, April 1940, Pages 245-248.

[3] "Power System for Pennsylvania Cars," *Railway Age*, March 1, 1947, pages 456-457.

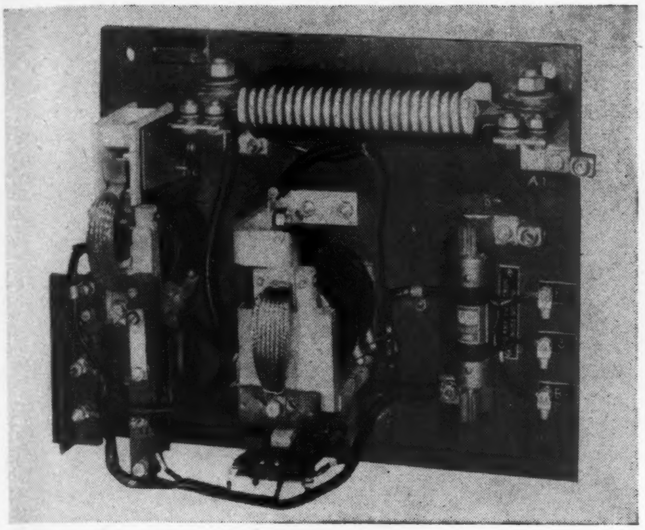


Fig. 9—D.c. starting panel type 17FM-63 for amplidyne booster inverter

D.c. to d.c. Booster

The development of fluorescent lights suitable for use on 60 volts d.c. led to some demands for a booster that would step up power from a variable-voltage nominal 32-volt circuit to 60 volts d.c. An ordinary motor-driven series booster can be used for this purpose,[4] but the response is slow and the control is bulky. A motor-driven amplidyne has been used to maintain 60 volts d.c. for fluorescent lights. The field of the amplidyne requires very little power and it was, therefore, possible to control the field directly by means of a glow tube. This scheme could be used in place of the inefficient lamp regulator for 60-volt fluorescent lamps operating on 64-volt batteries. The higher cost of the equipment has been a factor in preventing any but a few experimental installations from being made.

[4] "60 Volts D-c on 30-Volt Cars," *Railway Electrical Engineer*, July, 1941, pages 146-151.

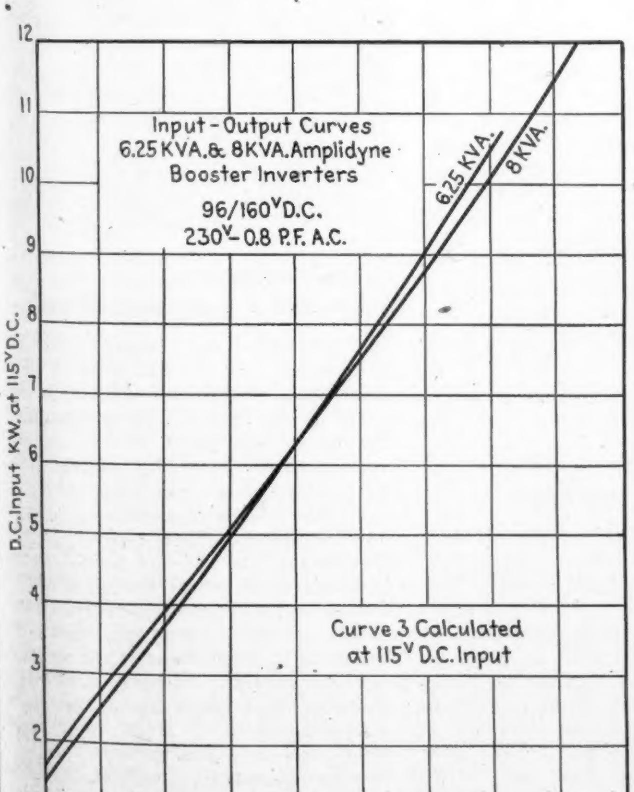


Fig. 10—Input-output curves for 6.25 kva. and 8 kva. amplidyne booster inverters

Variable-Voltage Variable-Frequency Inverter

This system may be used where relatively small motors are to be started from the a.c. bus while fluorescent lamps are in operation or where larger motors do not have to be started while fluorescent lamps are in operation. This method of supplying power for railroad passenger cars was suggested by M. A. Edwards, of the Consulting Engineering Laboratory, of the company with which the writers are associated. It has been in successful operation on a Pennsylvania Railroad car since early in 1945, supplying power to fluorescent lighting only.

Reduced Diesel Maintenance

(*Continued from page 374*)

sity of profitable manufacturing if they are to continue to serve the railroads in their growing need for this type of power. This unavoidable commercial aspect tends to bias the best judgment of the designing engineer because of costs, and locomotive builders can ill afford to furnish the most desirable apparatus while their competitors continue to supply, and the railroads to accept, apparatus of lower service capacity.

Standardization

It is obvious that it is possible and desirable to establish a limited number of standards for the construction of Diesel locomotives, particularly as to necessary margins in engine capacity, for electrical ratings, wheels and axles, electrical coupling details, battery sizes and compartments, and similar items. Such standards, of course, should be formulated by the railroads themselves after careful consultation with all locomotive builders and equipment manufacturers, since arbitrary standards might seriously limit developments and improvements of locomotives. In the growth of any industry, there is bound to be a wide diversity of opinion among engineers, which is a very healthy and stimulating influence, and only the prolonged experience of actual operation can prove the merits of one idea as compared to another. Nothing must be done to limit this type of progress at the present time.

It is suggested that the Mechanical Division of the Association of American Railroads might well appoint a committee charged only with the development of such standards and the publication of a Diesel motive power manual to which locomotive builders would be required to adhere in their products. This would be a major step toward the reduction of Diesel locomotive repair costs.

Summary

It is our opinion that the greatest relief from high electrical repair expenses may be obtained by (1) the use of electrical apparatus of adequate capacity; (2) strict adherence to tonnage ratings well within the capacity of the electrical transmission equipment; (3) the introduction of a limited number of standards so that all manufacturers will follow the same rules and electrical equipment capacity will not be sacrificed for the sake of commercial advantage.

—NEW DEVICES —

Beatty Press Brake

An hydraulic press brake of new design that provides a maximum amount of flexibility has been introduced by the Beatty Machine & Manufacturing Co., Hammond, Ind. The machine, Model 300, is of 300-tons' capacity.

This machine is adaptable to V-bending, flanging, pressing and straightening. It handles a wide variety of plate thicknesses without the need for minute ram adjustment. A number of factors for increasing productive speed have been incorporated in the machine: the ram advances at a maximum of 310 in. per min., returning at 285 in. per min., while pressing under full load takes place at 14 in. per min. These speeds are variable between 0 and maximum.

Balanced control of the ram is achieved through an equalizer which brings the ram down parallel with the bed through the use of racks and an idler pinion shaft.

Beatty press brake made in sizes up to 600 tons in weight and 12½ ft. between housings

The machine, of the open throat, closed-housing type, is built in capacities from 200 to 600 tons, and in sizes from 8 ft. 6 in. to 12 ft. 6 in. between housings. Stroke control features allow for operating in any portion of the stroke between the top and bottom limits.

Electronic Positioning Control

The three components of the system are a master control, an electronic panel and a follow-up

An electronic positioning control system designed for such applications as accurately controlling inaccessible dampers from control stations on the floor, positioning heavy work in machine tools without time-consuming hand labor, and opening, closing, and adjusting to intermediate points valves and gates from a single co-ordinated control desk has been announced by the Control Division of the General Electric Co.

The system has three parts—a master control station and a follow-up device, which can be either small selsyns or potentiometers, depending upon the application, and an electronic control panel. The driving motor is not included in the system because any reversing a.c. or d.c. motor that can handle the load is acceptable.

The master control station may be placed in any desired location, because it is connected to the control panel by just three control leads. To operate, a dial is set in the same manner as a radio dial, and the motor moves the load to a new position corresponding to that of the dial.

The system can be used on drives up to 1½ hp. in general, and on many drives over this rating, after consideration of inertia of the load, speed, gear reducer arrangement, and accuracy of positioning needs.

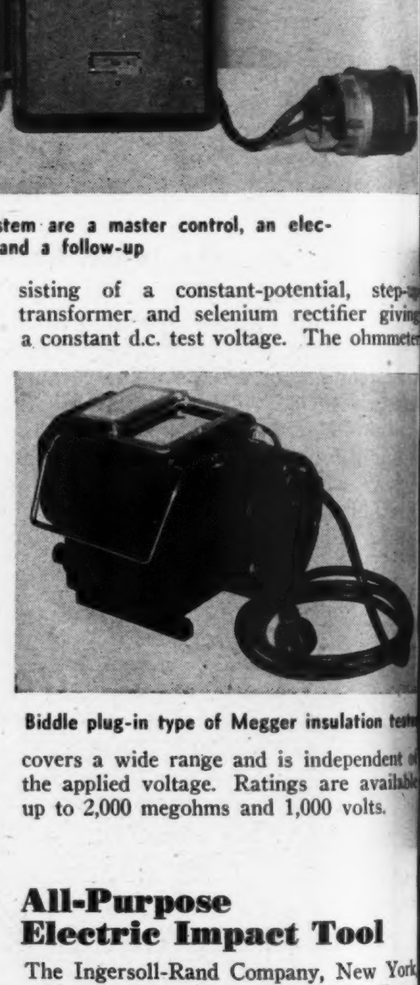
The control panel is enclosed in an NEMA Type I case and is hinged to swing out for easy servicing and inspection. The basic components of the system are standard control devices which have proved adequate and durable over long periods of operation.

Plug-In Insulation Tester

For those who need or prefer a Megger insulation tester that can be plugged in instead of hand cranked, the James G. Biddle Company, Philadelphia, Pa., has developed a rectifier-operated instrument. It operates on 115 volts a.c.

The instrument is intended for use where a large number of tests are to be made at one time or where an individual test is continued for many minutes. The latter includes dielectric absorption tests where careful observations of insulation resistance are made for ten or more minutes.

The rectifier-operated instrument is essentially a modification of the company's "Meg" type insulation tester. The hand generator is replaced by a power pack consisting of a constant-potential, step-up transformer and selenium rectifier giving a constant d.c. test voltage. The ohmmeter covers a wide range and is independent of the applied voltage. Ratings are available up to 2,000 megohms and 1,000 volts.



Biddle plug-in type of Megger insulation tester

All-Purpose Electric Impact Tool

The Ingersoll-Rand Company, New York, announces a new universal electric, all-purpose impact tool. This machine is designated as the Size 4U. It weighs 6½ lb., has an over-all length of 10½ in. and a free speed of 2,000 r. p. m. and delivers 1,900 rotary impacts per minute under load. It is powered with a specially designed reversible universal electric motor (3 amp.) that operates on 110-volt a.c.-d.c. current.

Standard equipment furnished with the impact tool includes a collet-type chuck to handle all round shank attachments from 3/16 in. to 3/8 in. in diameter and square end taps and reamers, six hexagon sockets 7/16 in. to 3/4 in., a No. 2 Morse taper socket, a No. 1 to No. 2 Morse taper adapter sleeve and an Allen wrench. Other accessory equipment is available if required.

The impact tool runs just as any conventional electric tool until the resistance to spindle rotation reaches a certain amount. Then a patented mechanism converts the power of the motor into "rotary impacts" which exert a more powerful turning ef-

ect. An outstanding advantage claimed for the impact mechanism is that it permits the spindle to be stalled completely while the motor continues to run; thus eliminating motor burn-outs caused by overloading. The impact mechanism also eliminates torque reaction to the operator. There is no kick or twist under any condition.

The following operations can be performed with the impact tool using standard attachments: The unit is conservatively rated to apply and remove nuts and cap screws up to ⅜-in. thread size. It will drill ¼-in. holes in metal and up to ½-in. by step drilling and will ream up to ½-in. diameter. The tool will handle taps from ¼-in. to ½-in., drive and remove all types of machine screws up to ⅜-in. thread size and wood screws up to size No. 20, and drive and remove studs up to ⅜-in. thread size. It will extract broken cap screws and studs up to ⅜-in. thread size. Various types of wire brushes with round shanks up to ⅜-in. diameter can be used

The Ingersoll-Rand electric impact tool being used to apply cap screws on an electric motor

with the tool. For boring wood it will take sizes up to ⅜-in. twist drills with the collet-type chuck and up to 29/32-in. with Morse taper. Brick and masonry can be drilled using carbide-tipped drills up to ⅜-in. diameter.

Plastic Upholstery

A plastic upholstery, especially designed for heavy-duty transportation seating, is being made by United States Rubber Company, Rockefeller Center, New York 20. The material, known as Heavy-Duty Naugahyde, provides extra bulk for greater durability and more luxurious appearance. It is available in a variety of colors. Since it is 50-in. wide and put up in rolls 50-yd. long, seat patterns can be laid out satisfactorily in any direction over the entire area.

Advantages claimed for the upholstery are long wear, outstanding abrasion resistance, and excellent flexing and tailoring properties. It is said to be practically immune to the effects of perspiration, oils, sunlight and weathering. It can be cleaned with soap and water and will not get hard, or crack, nor bag and form wrinkles on deep spring soft seats.

Metal Saw With Automatic Cutting

A new heavy-duty horizontal metal-cutting band saw, recently put on the market by the Wells Manufacturing Company. Three Rivers, Mich., features an automatic cutting cycle in which the blade is fed into the work at a constant pressure and the cutting head is returned by hydraulic power to its starting position above the work upon completion of the cut. Elimination of manual operations is designed to reduce operator fatigue and make possible higher production, while control of the blade pressure is claimed to result in a better cut, more efficient operation, and greatly reduced blade breakage.

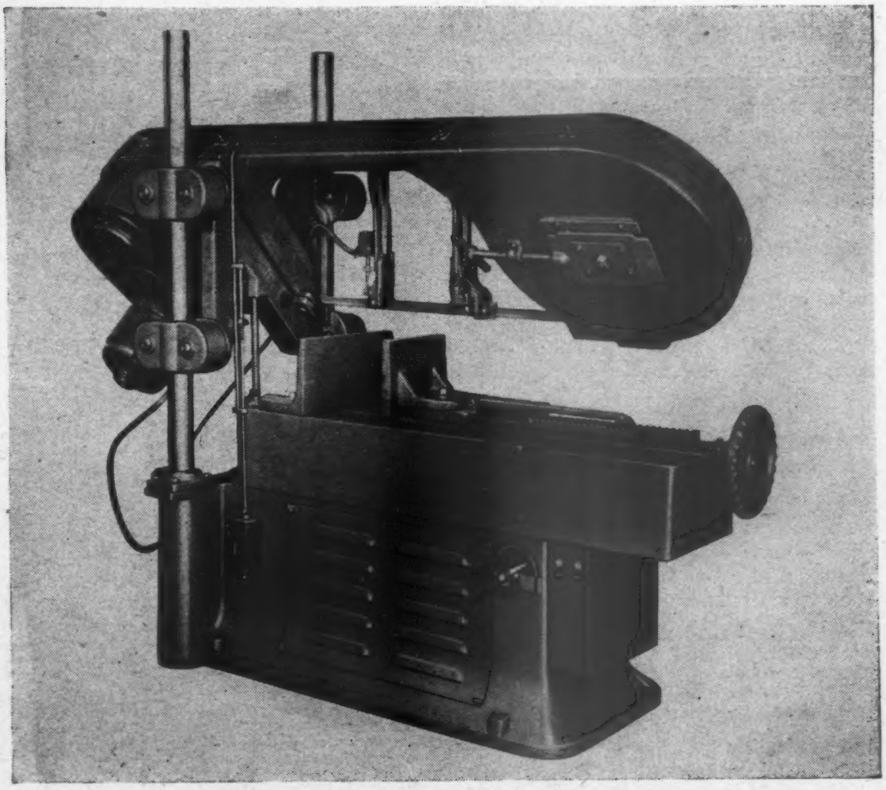
The saw, designated Model 12, is designed for cutting off rectangular stock up to 12 in. deep by 16 in. wide or cylindrical stock up to 12¾ in. diameter. In addition to cutting through stock, the saw can be automatically controlled to cut to any desired depth for work on dies or other parts.

The saw is of heavy, rigid construction. The base and bed are castings. The cutting head rides on closely fitted rollers on two heavy columns. The hydraulic system is enclosed in the base. The saw blade is enclosed except at the cutting zone. The vise is of the quick-acting type. Cutting speeds are 50, 90, or 150 ft. per min. A ¾-hp. motor drives the blade and a ⅛-hp. motor drives the hydraulic pump. Overall dimensions are 59 in. high by 78 in. long by 32 in. wide. The shipping weight is approximately 1750 lb.

After controls have been set for the work to be done, operation of the saw is by means of two start-stop stations mounted on the base. First the blade motor is started and then the control circuit is closed. The latter opens a solenoid valve which bleeds oil out of a hydraulic cylinder connected to the cutting head, permitting the head to feed down into the work.

The rate of feed is controlled in order to maintain a constant limited pressure between the blade and the stock. This is accomplished by a manually adjustable needle valve which limits maximum flow of oil from the cylinder and a spring loaded micro switch, the arm of which rides on the blade. The instant excessive pressure deflects the blade, the switch closes the previously mentioned solenoid, interrupting the flow of oil from the cylinder to stop the descent of the head. The instant the excess pressure is relieved the micro switch opens the solenoid, permitting the feed to resume. The micro switch is sufficiently responsive to pressure changes that no variation in feed is visible, nor is there any measurable effect upon the cut.

Upon completion of the cut, a mechanically operated limit switch breaks the circuits to the blade motor and pressure control system and starts a motor-driven pump which actuates the hydraulic cylinder, raising the cutting head. When the cutting head reaches a predetermined height sufficient to clear the work, the limit switch cuts out the pump motor and the cycle is ready to be repeated. Trips on the limit switch control arm can be set to stop the saw at any depth and raise the head to any height.



Wells No. 12 metal-cutting band saw with automatic cutting cycle

NEWS

Research Advisory Committee on Journal Bearings

A Research Advisory Committee for Railroad Journal Bearing Manufacturers has recently been appointed with offices at 721 Railway Exchange Building, Chicago. Members of the committee are: I. E. Cox, vice-president in charge of engineering, National Bearing Division, American Brake Shoe Company, St. Louis, Mo.; R. J Shoemaker, chief engineer, Magnus Metal Corporation, Chicago; and E. S. Pearce, president, Railway Service & Supply Corp., Indianapolis, Ind.

This committee will study railway journal-bearing performance from an operating and maintenance standpoint and cooperate with all committees of A. A. R. Mechanical Division which are concerned with improvement of the present A. A. R. journal-bearing assembly.

Washing Tubes and Flues—A Correction

THE equipment for washing tubes and flues on the New York Central described on page 247 of the May issue of the RAILWAY MECHANICAL ENGINEER is patented and furnished by The Superheater Company, New York. This fact was not mentioned in the article.

M. R. S. Veterans to Meet in Chicago

A REUNION of veterans of World War II Military Railway Service headquarters, grand division, shop and operating battalion men has been arranged for September 27 at Chicago. Registration at the Palmer House will precede a business session there at 11 A. M., to be opened by a greeting by Major Gen. Carl R. Gray, Jr., vice-president of the Chicago & North Western. An afternoon at the baseball park will be followed by a dinner and smoker at the Palmer House, to which wives will be welcome. Tickets are available from S. R. Truesdell, treasurer, 400 West Madison street, Chicago 6, at $7.50 each ($5.70 omitting the ball game).

Amends Salary Provisions of Locomotive Inspection Act

PRESIDENT TRUMAN has signed a recently-enacted bill (H. R. 2123) which amends the salary provisions of the Locomotive Inspection Act, giving the Interstate Commerce Commission authority, subject to applicable civil service laws, to fix the compensation of the director and assistant directors of the Bureau of Locomotive Inspection. The amendments also require the commission to provide district inspectors with necessary office space and clerical and stenographic help.

The act formerly fixed the salaries to be paid and provided the district inspectors with allowances for office rent and clerical and stenographic help. In reporting the bill to the House, the committee on interstate and foreign commerce said the amendments would make the Locomotive Inspection Act "conform to the present personnel policy of the government."

Moriarty Heads Malleable Founders Society

WILSON H. MORIARTY, vice-president of the National Malleable & Steel Castings Co., Cleveland, Ohio, was elected president of the Malleable Founders Society for the coming year at the Society's fiftieth anniversary meeting held at Hot Springs, Va.

Germans Use Concrete to Build Freight Cars and Brake Shoes

FREIGHT cars made from prestressed, reinforced cast concrete are being manufactured in Heidelberg, Germany, according to a preliminary report by the overseas operating staff of the Office of Technical Services of the United States Department of Commerce. All parts of the freight car except the wheels, springs and drawbars are made from cast concrete, the report added, and one manufacturer has announced the receipt of orders for 1,000 such cars. Full details about this development eventually will be released through the O.T.S.

Munich street railways have been using

Orders and Inquiries for New Equipment Placed Since the Closing of the June Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Atchison, Topeka & Santa Fe	8	6,000-hp. Diesel-elec. pass.	Electro-Motive
	4	4,000-hp. Diesel-elec. pass.	American Locomotive
	4	1,000-hp. Diesel-elec. switch.	American Locomotive
	6	1,000-hp. Diesel-elec. switch.	Baldwin Locomotive
	1	2,000-hp. Diesel-elec. trans.	Baldwin Locomotive
	2	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
Central of New Jersey	3[1]	2,000-hp. Diesel-elec. pass.	Baldwin Locomotive
Chicago & North Western	10[2]	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
	1	1,000-hp. Diesel-elec. switch.	American Locomotive
	7[2]	660-hp. Diesel-elec. switch.	American Locomotive
	3	1,500-hp. Diesel-elec. road switch.	Baldwin Locomotive
Chicago Great Western[3]	9	1,000-hp. Diesel-elec. switch.	Electro-Motive
	5	660-hp. Diesel-elec. switch.	American Locomotive
Illinois Terminal	6	1,000-hp. Diesel-elec. yd. switch.	American Locomotive
	3	1,000-hp. Diesel-elec. rd. switch.	American Locomotive
St. Louis-San Francisco	26	1,500-hp. Diesel-elec. frt.	Electro-Motive
	6	1,000-hp. Diesel-elec. switch.	Fairbanks-Morse
	4	1,000-hp. Diesel-elec. switch.	Electro-Motive

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Atchison, Topeka & Santa Fe	250[1]	70-ton gondola	American Car & Fdry.
	125[1]	70-ton covered hopper	American Car & Fdry.
Duluth, Missabe & Iron Range	500[4]	70-ton ore	American Car & Fdry.
Louisville & Nashville	1,500[5]	50-ton hopper	Bethlehem Steel
	1,500[5]	50-ton hopper	Pullman-Standard
Missouri-Kansas-Texas	300[6]	50-ton box	American Car & Fdry.
	200[6]	70-ton hopper	American Car & Fdry.
New York Central	1,000	55-ton box	Greenville Steel Car
	1,000	55-ton box	American Car & Fdry.

FREIGHT-CAR INQUIRIES

Road	No. of cars	Type of car	Builder
Baltimore & Ohio	2,000	70-ton hopper	
Illinois Central	1,500	50-ton hopper	

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Chicago, Milwaukee, St. Paul & Pacific	56	Coaches	Company Shops
	6	Dining	Company Shops
	2	Dining-lounge	Company Shops
	2	Tap-room-dining-lounge	Company Shops
	12	Parlor	Company Shops
	6	Cafe-parlor	Company Shops
	2	Bagg.-dormitory	Company Shops
	17	Mail-express	Company Shops
	20	Baggage	Company Shops
	2	Post-office	Company Shops

[1] The gondola cars are scheduled for delivery during first quarter of 1948; the hopper cars, during the second quarter.

[2] For suburban service. Aggregate cost $540,000.

[3] Five 1,000-hp. locomotives and 1 660-hp. locomotive for the Chicago, St. Paul, Minneapolis & Omaha.

[4] The Chicago Great Western has received one 1,000-hp. Diesel-electric switcher from the American Locomotive Company, which is part of an order for three such units placed by the road earlier this year.

[5] Delivery of Bethlehem built cars to begin next December; Pullman-Standard cars, early in January, 1948.

[6] Delivery expected early in 1948.

NOTES:—*Minneapolis, St. Paul & Sault Ste. Marie.*—The purchase of 10 3,000-hp. Diesel-electric road locomotives for use in main line service has been approved by the board of directors of the Soo Line. The road recently ordered eight 1,500-hp. Diesel-electric road switchers from the Baldwin Locomotive Works for use on branch lines, as reported in the June issue.

The *New York, New Haven & Hartford* has been authorized by the United States district court at New Haven, Conn., to purchase 35 Diesel-electric locomotives at a total cost of $3,850,000. Twenty will be of the road-switching type, of which 10 will be 1,500 hp. and 10 1,000 hp. The remaining locomotives include [illegible] 660-hp. switchers and 2 44-ton switchers.

concrete brake shoes for several years, it also was reported, thus eliminating a need for cast iron which formerly used up about four tons of the metal each day. The concrete brake shoes, it was said, last about three months.

Inspection of Corrosion Tests At Kure Beach, N. C.

On June 4 and 5 the International Nickel Company, the Dow Chemical Company and the Carnegie-Illinois Steel Corporation were hosts to a group of engineers and technical editors at the Corrosion Testing Station, Kure Beach, N. C. The Kure Beach station was established by the International Nickel Company in 1935 for the purpose of comparing the corrosion resistance of low-alloy steels with carbon steel. Since that time, other materials have been added to the test program so that now comparative tests are being made of many kinds of ferrous and non-ferrous metals and alloys which are the products of more than 100 manufacturers.

In general, tests of two types are carried on at Kure Beach, those having to do with exposure to atmospheric attack and with exposure to the corrosive action of sea water by immersion. The atmospheric test lot has an ultimate capacity of about 36,000 specimens, some 15,000 being on the racks under exposure at the present time. In addition to the specimens exposed to the atmosphere about 2,000 specimens are now exposed to sea water and, over a period of 12 years, the number so tested has been over 10,000. Included in the sea-water tests are a substantial number of wood specimens embracing many types of wood treatment to determine the resistance of the different types of treatment to marine borers.

An important part of the facilities at Kure Beach is a laboratory equipped for measurements as to loss of weight of samples, microscopic examinations, etc. This laboratory checks all specimens periodically, keeping an accurate record of exposure time, location of the specimens and information relating to performance under test conditions.

Miscellaneous Publication

Silicone Data Sheet. Dow Corning Corporation, Midland, Mich. Preliminary Data Sheets No. B-30-1 gives specifications for rewinding induction motors with Silicone insulation and lists the materials necessary to insure maximum service life of such rewound motors.

Nicholson Thermic Syphons. Locomotive Firebox Company, 310 South Michigan avenue, Chicago 4. Bulletin No. 17 (90 pages) shows, by diagrams, how Nicholson Thermic syphons protected crown sheets in specific instances when low water occurred by pouring water over the entire sheet except a small portion directly ahead of the syphons. Low-water line shown in each instance, also the small overheated area which pulls away from a few radial staybolts, thereby warning the the crew, permitting the pressure to escape gradually, and so preventing serious boiler explosions. Gives costs for repairing crown sheets on syphon-equipped locomotives following instances of low water.

Supply Trade Notes

Grip Nut Company.—*C. A. Hendrickson* has been appointed assistant mechanical engineer of the Grip Nut Company, with headquarters at 310 S. Michigan avenue, Chicago 4.

◆

Crucible Steel Company of America.—Marking the completion of the first large project in the $30,000,000 expansion and improvement program of the Crucible Steel Company of America, officers and plant managers of company toured its new spring work at Pittsburgh, Pa., on June 17, accompanied by editors and writers from newspapers, industry magazines, and technical journals. One of the country's most modern plants for the manufacture of heavy-duty coil and elliptical springs, the Crucible Steel spring works supplies thousands of different sizes and shapes of springs to railroads direct, to car and locomotive manufacturers, and to builders of special heavy equipment. The 51-in. coil springs for the Duryea cushion underframe are produced at this plant. Automatic machinery and special processes, largely designed and installed by M. V. O'Donnell, manager of the plant, and his production staff, have been adapted to spring manufacture in the new plant. Until May, 1947, Crucible Steel spring operations also were carried on in the McKees Rocks plant where the company's spring-making activities began in 1909. The new spring works was acquired in 1945. The McKees Rocks plant was kept in operation during the two-year period of consolidation and modernization which today is completed in all major details. The new plant has a capacity of about 3,000 tons of springs per month.

Matched assemblies of car and locomotive elliptical springs at the new spring works of the Crucible Steel Company of America at Pittsburgh, Pa., which produces both the coil and elliptical types

◆

Simmons-Boardman Publishing Corporation.—*Harry H. Melville,* formerly assistant to the vice-president, Simmons-Boardman Publishing Corporation, has been appointed district sales manager for the central district in charge of advertising sales for the firm's transportation publications. Mr. Melville, whose headquarters will be at Cleveland, Ohio, succeeds *F. H. Thompson,* who, as vice-president, will serve in an advisory capacity.

H. H. Melville

◆

Oakite Products, Inc.—*Sterling E. Killebrew* has been appointed manager of Oakite's Railway Service Division, suc-

ceeding Bennett C. Browning, who has resigned from his Chicago post.

Sterling E. Killebrew attended Washington University at St. Louis, Mo., and was for a time engaged in construction and mechanical engineering work in that city. For the past four years he was in charge of the southwestern territory of the Rail-

S. E. Killebrew

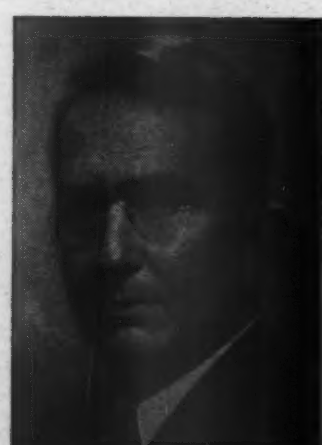
way Service Division of Oakite. As manager of the division he will direct the activities of the field representatives of the division from new divisional headquarters at New York.

◆

D. J. MURRAY MANUFACTURING COMPANY.—The D. J. Murray Manufacturing Company, Wausau, Wisc., has announced the removal of its Chicago office from 43 East Ohio street to 38 South Dearborn street. *O. J. Molina,* sales manager of the heating and ventilating division, is in charge of the office.

◆

GENERAL STEEL CASTINGS CORPORATION.—*J. C. Travilla,* chief mechanical engineer of the General Steel Castings Corporation since 1940, has been elected vice-president-engineering. *James MacDonald,* assistant to the president, has been elected vice-president, and *B. W. Taylor* has been ap-



J. C. Travilla

pointed assistant to the vice-president-engineering.

J. C. Travilla, a graduate of Cornell University with a degree in mechanical engineering, joined the Commonwealth Steel Company in 1923 as an estimator and has worked for that company and its successor, General Steel Castings, in various engineering capacities at the Commonwealth and Eddystone, Pa., plants.

James MacDonald entered the sales department of General Steel Castings in January, 1939, and was appointed assistant to vice-president-sales later in the same year. He came to General Steel Castings from the Baldwin Locomotive Works where he had served over a period of eight years as general assistant to the treasurer, purchasing agent and assistant director of

James MacDonald

sales. He became assistant to the president in July, 1945.

B. W. Taylor, who after his release from the Navy in October, 1946, was appointed assistant chief mechanical engineer, is a

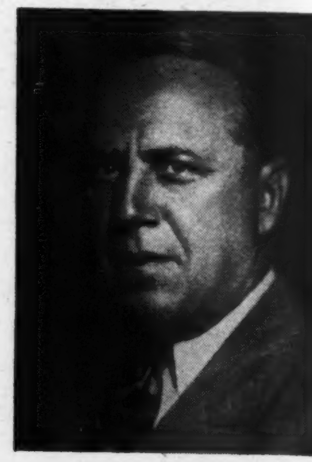
B. W. Taylor

graduate of the University of Pennsylvania with a degree in mechanical engineering (1917). He was an instructor of mechanical engineering at the university from 1920 to 1923 and railway engineer of S. K. F. Industries from 1923 to 1943.

◆

PYLE-NATIONAL COMPANY.—*Harold V. Engh,* executive vice-president of the Anaconda Wire & Cable Co., at New York, has been elected president of the Pyle-National Company, with headquarters at Chicago, succeeding *J. A. Amos,* who has resigned. *Alvo N. Martin* has been re-elected vice-president.

Harold V. Engh was born at Chicago and educated at Lane Technical High School in that city. He started his business career with the Chicago Insulated Wire & Manufacturing Co., and rose steadily through various departments. During World War I he enlisted in the U. S. Air



Harold V. Engh

Service and served both in this country and abroad as an officer pilot. Before he reached his twenty-seventh birthday, he was elected vice-president of Illinois Wire & Cable Co. In 1928 he became president of the Inland Cable Company. When Inland consolidated with the Anaconda Wire & Cable Co., in 1929, Mr. Engh joined Anaconda as vice-president.

◆

JOSEPH T. RYERSON & SON.—William G. Findlay has been appointed manager of the Pittsburgh, Pa., plant of Joseph T. Ryerson & Son, to succeed Howard L. Robinson who has been assigned special duties at the Cleveland, Ohio, plant. Mr. Findlay, who has been with the company for 25 years, was previously manager of the work order division at Chicago. C. W. Schoenberg, manager of Ryerson's steel-service plant in Milwaukee, Wis., for the past 14 years, has been appointed manager of the work order department at Chicago to succeed Mr. Findlay.

AMERICAN ARCH COMPANY.—*Frank D. Hazen,* formerly general sales manager of the industrial department of the American

Frank D. Hazen

Arch Company, has been appointed vice-president and general manager of that department, with headquarters at Pittsburgh, Pa. Mr. Hazen has been associated with

RESULTS on the C AND O

Lima-built Class H-8 Locomotive
Type 2-6-6-6

NORTHERN SUB-DIVISION TESTS

Place: Russell, Ky. — Columbus, Ohio

Grade: Principal grade between Russell, Ky. and Columbus, Ohio extends for a distance of 17¼ miles of which 1¼ miles has a grade of +.7%, with the remainder varying from .0 to + .20%.

Coal Consumption: Coal per 1,000 gross ton miles for 4 loaded trips averaged 40.68 lbs. The maximum for a train was 49.58 and the minimum 31.93 lbs.

Water Consumption: Water per drawbar horse power hour for 4 loaded trips averaged 23.12 lbs. The maximum for a train was 25.95 and the minimum 20.77 lbs.

Acceleration: A test stop was made with a train consisting of 160 loads (14,083 tons). The locomotive started the train with a maximum drawbar pull of 117,500 lbs. and 6 minutes later had moved the train one mile, the speed accelerating to 19 mph. A speed of 29 mph was reached 11 minutes after starting.

INCORPORATED • LIMA, OHIO

the company for 22 years, prior to which he was engaged in construction work for the Inland Steel Company and the Illinois Steel Company.

◆

AMERICAN ROLLING MILL COMPANY.—*Robert Y. Barham,* assistant district manager of the American Rolling Mill Company, Chicago, has been appointed district manager of the recently combined Boston and New York districts, with headquarters at New York, succeeding *Wallace B. Quail,* district manager at New York, and *Donald Hogan,* district manager at Boston. Mr. Quail has been appointed manager of the central sales area, with headquarters at Middletown, Ohio, and Mr. Hogan district manager at Cleveland, Ohio.

Robert Y. Barham

Robert Y. Barham attended the University of California, and was an assistant division engineer of the Southern Pacific before starting has career with subsidiary companies of the American Rolling Mill Company. He was sales manager and district manager of various Armco subsidiaries at San Francisco, Calif., Houston, Tex., and Chicago, beginning in April, 1926. He went to Chicago in 1939 as district manager of Armco Railroad Sales, and served in that capacity until August 1, 1945, when that subsidiary was combined with the parent company. He then became assistant district manager of the parent company in Chicago.

◆

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY.—*James H. Binger,* assistant secretary of the Minneapolis-Honeywell Regulator Company, has been elected assistant vice-president to assist Thomas McDonald, vice-president in charge of sales. The Chicago office of the company has been moved to 351 East Ohio street.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Malcolm W. Reed,* chief engineer of the Carnegie-Illinois Steel Corporation (a subsidiary of the United States Steel Corporation), has been elected engineering vice-president.

Malcolm W. Reed, a graduate of the U. S. Naval Academy, entered the service of the American Steel & Wire Co. (also a subsidiary of U. S. Steel) in 1916 as a wire tester, at Worcester, Mass. He became wire rope engineer in 1917 and foreman of the rope mill at New Haven, Conn., in 1919. He advanced to the superintendency of the New Haven plant, and in 1928, returned to Worcester as assistant district manager. In 1932, he was appointed chief engineer, with offices at Cleveland, Ohio; in 1933, assistant to the vice-president and chief engineer; in 1937, vice-president in charge of operations, and in 1939, chief engineer of Carnegie-Illinois.

◆

LORD MANUFACTURING COMPANY.—*Stephen J. Zand* has been appointed vice-president in charge of engineering of the Lord Manufacturing Company. Mr. Zand, who has been working with Lord Manufacturing as consulting vibration engineer since 1933, will devote his full time to the company and will be responsible for all engineering, research and development activities for the product engineering and research divisions.

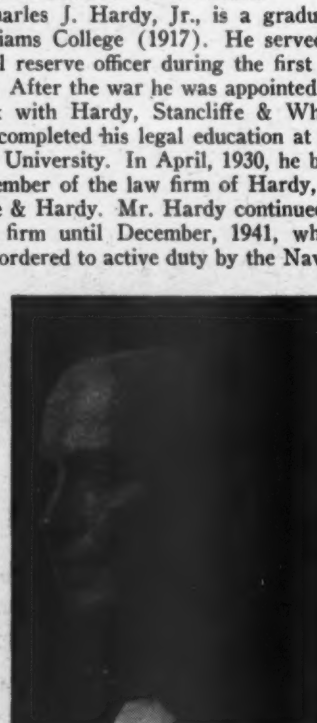
◆

EATON MANUFACTURING COMPANY.—*Edward J. Helline* has been appointed general sales manager of the Reliance division of the Eaton Manufacturing Company, Massillon, Ohio. For the past three years Mr. Helline was in charge of snap ring sales engineering and production.

◆

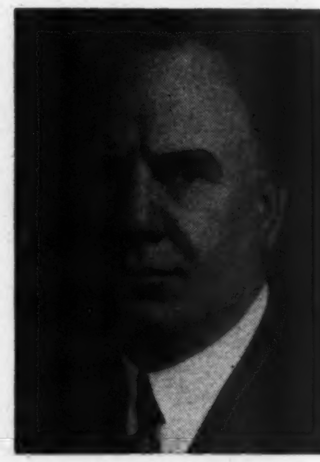
AMERICAN CAR AND FOUNDRY COMPANY.—*Charles J. Hardy, Jr.,* executive vice-president of the American Car and Foundry Company, has been elected president to succeed *F. A. Stevenson,* who resigned after having been associated with the company for over 40 years. Mr. Hardy continues as chairman of the board.

Charles J. Hardy, Jr., is a graduate of Williams College (1917). He served as a naval reserve officer during the first world war. After the war he was appointed a law clerk with Hardy, Stancliffe & Whitaker and completed his legal education at Fordham University. In April, 1930, he became a member of the law firm of Hardy, Stancliffe & Hardy. Mr. Hardy continued with that firm until December, 1941, when he was ordered to active duty by the Navy Department. Assigned to headquarters, office of the commandant, third naval district, he held the rank of lieutenant-commander when released to inactive duty in March, 1944. He was elected vice-president and a member of the board of directors of American Car and Foundry in September, 1944, and executive vice-president on March 21, 1946.



C. J. Hardy, Jr.

F. A. Stevenson was born in Detroit, Mich., on April 6, 1880. He began his career as an apprentice in the shops of the Peninsular Car Company, Detroit, which later became part of the American Car and Foundry group. He subsequently held the position of master mechanic, assistant general manager, assistant vice-president in charge of operations, vice-president and senior vice-president. During World War I, Mr. Stevenson was in charge of the company's Detroit, Depew, N. Y., and Buffalo plants, which were engaged in the manufacture of artillery vehicles, shells and other war materiel. As senior vice-president, the department of research and development was under his jurisdiction. Mr. Stevenson was elected president in April, 1944.



F. A. Stevenson

◆

TIMKEN ROLLER BEARING COMPANY.—The Timken Roller Bearing Company, Canton, Ohio, has announced the opening of a new branch plant in St. Thomas, Ont., under the management of John Jolly.

◆

RELIANCE MACHINE & STAMPING WORKS.—The ownership of the Reliance Machine & Stamping Works has been transferred to *J. J. Prendergast, M. Wilkinson,* and *C. B. Camp,* all formerly with the Texas & Pacific. The company's general office has been moved from New Orleans, La., to Dallas, Tex.

◆

HENNESSEY LUBRICATOR COMPANY.—*Charles C. Dempsey,* who was associated with the Hennessey Lubricator Company for a number of years before the war, has returned to the company as special representative, following his recent release from the United States Army.

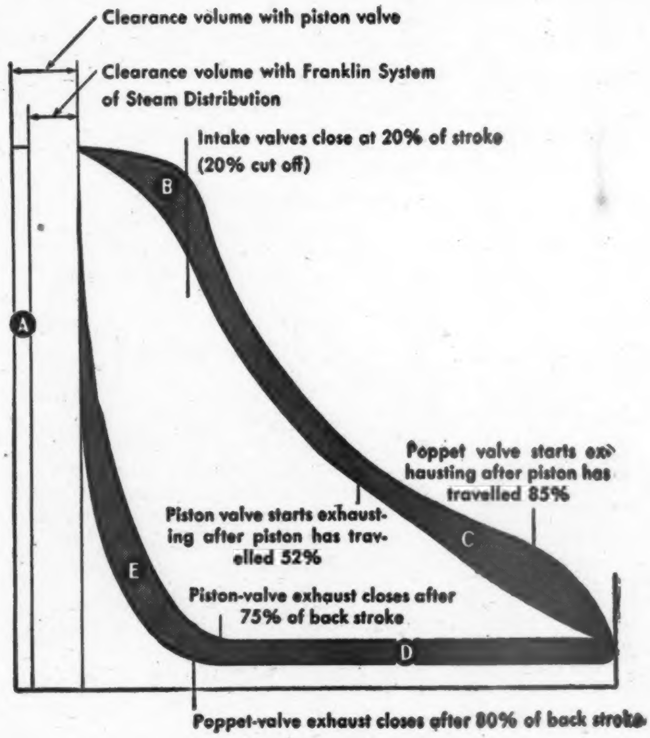
◆

AIR REDUCTION SALES COMPANY.—H. C. Wallace, formerly assistant sales manager of the Louisville, Ky., district of the Air Reduction Sales Company, has been appointed manager of that district, to succeed the late R. S. Moore. Mr. Wallace, with headquarters in the district sales office at Louisville, will be responsible for the operations of all plants and offices of Air Reduction in that district, which covers Kentucky, Tennessee and part of Indiana.

◆

ELECTRO-MOTIVE DIVISION, GENERAL MOTORS CORPORATION.—A new research center to develop "locomotives of tomorrow" will be opened at La Grange, Ill., this

MORE POWER FROM THE BOILER



A With reduced clearance volume (space between intake valves and piston at end of stroke) more economical use is made of the steam admitted to cylinders.

B With larger steam flow areas and faster valve openings, steam enters the cylinder with smaller pressure drop. This increases the amount of steam admitted for a given cut-off — increases the power output for a given cut-off, or permits the use of a shorter and more economical cut-off for a given power output.

C With late release, the expansion period is increased substantially. This increases efficiency by increasing the amount of heat transformed into mechanical work.

D With late release and large exhaust areas, the back pressure is lower, which again increases the power obtained from a given amount of steam.

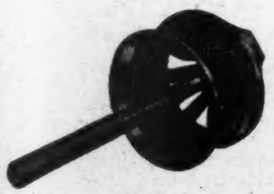
E With low back pressure, and late compression, excessive pressures at the end of the back stroke are avoided. Economical short cut-offs can be used without severe reactions on the running gear.

WITH

THE FRANKLIN SYSTEM OF STEAM DISTRIBUTION

These indicator cards represent a locomotive equipped with the Franklin System of Steam Distribution and a locomotive, identical in all other respects, equipped with piston valves. Both cards are based on high-speed operation at 20% cut-off.

As can be seen, the engine equipped with poppet valves can utilize full boiler capacity because of the larger steam flow areas and the faster opening and closing of valves. It develops more horsepower per pound of steam. It uses less fuel and water to deliver a given horsepower output.



FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO • MONTREAL

STEAM DISTRIBUTION SYSTEM • BOOSTER • RADIAL BUFFER • COMPENSATOR AND SNUBBER • POWER REVERSE GEARS
AUTOMATIC FIRE DOORS • DRIVING BOX LUBRICATORS • STEAM GRATE SHAKERS • FLEXIBLE JOINTS • CAR CONNECTION

summer by the Electro-Motive Division of General Motors Corporation. The new center will be housed in a $1,000,000 building adjacent to the La Grange plant and will permit concentration of engineering and research work now in progress at various points within Electro-Motive's main manufacturing plant.

◆

DeVilbiss Company.—One week courses devoted to lectures, demonstrations and actual practice in spray painting will begin on July 21, August 18, October 6, and December 1, respectively, at the DeVilbiss spray painting school in Toledo, Ohio. The training is available without charge to industrial finishers operating DeVilbiss spray equipment.

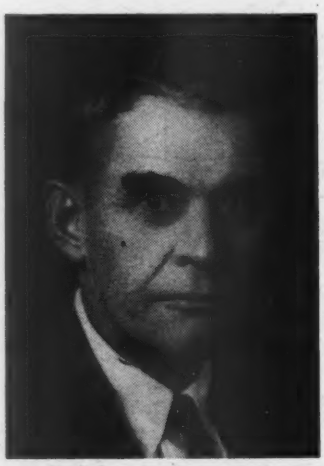
◆

Commercial Metals Company.—The Commercial Metals Company has moved its offices from 1626 Kirby building to Latimer and Corinth streets, Dallas, Tex.

◆

Midvale Company.—*Richard T. Nalle* has been elected president of the Midvale Company to succeed *Francis Bradley*, who has been elected chairman of the board.

Richard T. Nalle was born in Philadelphia, Pa., in 1889. He graduated from



Richard T. Nalle

the University of Pennsylvania in 1910 with a degree in electrical engineering and, in the same year, joined the Pennsylvania as special apprentice in the motive power department at Altoona, Pa. In 1913 he became industrial engineer for Day & Zimmerman, and in 1917 joined the United States Army, where he served until 1918. Mr. Nalle was appointed works manager and vice-president in charge of operations of Henry Disston & Sons in 1920. In 1945 he joined Midvale as executive vice-president.

◆

Baldwin Locomotive Works.—*Roland C. Disney*, formerly manager of eastern district sales of the Baldwin Locomotive Works, has been appointed assistant general sales manager and *Edwin R. Wisner* manager of eastern district sales to succeed Mr. Disney.

Roland C. Disney earlier in his career was a member of the engineering department of the Western Electric Company for 11 years. Just before joining Baldwin, he served as a lieutenant colonel with the United States Army.

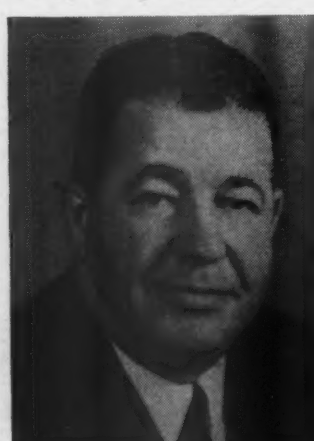
Edwin R. Wisner began his business career with the Westinghouse Electric & Manufacturing Corp. During the recent war he joined the United States Maritime Commission's production division, of which he was later appointed director. He resigned in September, 1945, and spent a year in the electric power department of the Elliott Company before going with Baldwin.

◆

Koppers Company.—*John A. Worthington* has been appointed general sales manager of the piston ring division of the Koppers Company and *T. Latimer Ford* has been appointed head of a newly established department devoted exclusively to replacement sales.

John A. Worthington

John A. Worthington joined the Bartlett Hayward Company (now a division of Koppers) in 1916 as an inspector, becoming foreman in 1919. He was transferred to the American Hammered Piston Ring division in 1920 as assistant shop superintendent. Two years later, he was appointed an engineer in that division and since 1925 has been manager of industrial sales and engineering.



T. Latimer Ford

T. Latimer Ford joined the Bartlett Hayward Company in 1908 and in 1919 was appointed assistant secretary and treasurer of the American Hammered Piston Ring Company. He was appointed Pacific Coast district sales manager in 1921 and vice-president and sales manager in 1927. The position of vice-president was abolished in 1936, when American Hammered was consolidated with Koppers, at which time Mr. Ford became sales manager of the automotive division.

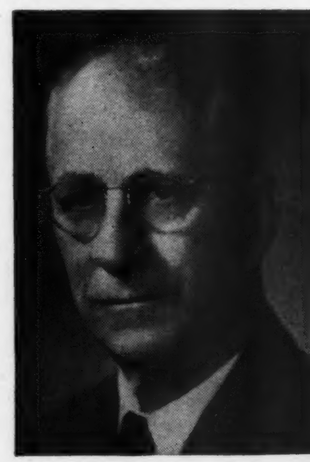
◆

Aluminum Company of America.—*George J. Stanley*, director, vice-president and general sales manager of the Aluminum Company of America, has retired as vice-president and general sales manager, but continues as a director. *Ralph V. Davies, Robert B. McKee*, and *Donovan Wilmot*, assistant general sales managers, have been appointed vice-presidents. Mr. Davies becomes also general sales manager for the Aluminum Company, succeeding Mr. Stanley.

◆

Thomas A. Edison, Inc. — *John R. Brown*, formerly sales engineer for the primary battery division of Thomas A. Edison, Inc., has been appointed Pacific coast sales manager for that division, with headquarters at San Francisco, Calif., to succeed Edwin W. Newcomb, deceased.

John R. Brown was born in Grant, Mich., on May 30, 1883, and is a graduate of Northwestern University (1908). In December, 1909, he joined the engineering and valuation departments of the Union Pacific. From 1912 to 1918, he served successively as signal draftsman and signal inspector



John R. Brown

for the Oregon Short Line. In the latter year, he joined the General Railway Signal Company, where has was assigned to signal construction and special field work. Mr. Brown was appointed sales engineer for the primary battery division of the Edison company in May, 1920.

Obituary

John H. Link, sales engineer of W. H. Miner, Inc., died at his home in Havertown, Pa., on May 27, following a long illness. Mr. Link was born in Chicago in 1890, and joined W. H. Miner in 1911. After experience in the mechanical and production departments of the company, he became sales engineer in 1919, with headquarters at Chicago. He was transferred to the Philadelphia (Pa.) area in 1926, where he remained active in railroad work until his death.

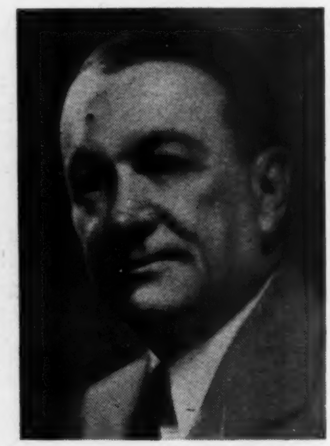
◆

Charles J. Anderson, sales representative of the Garlock Packing Company, died on June 5, at his home in Westfield, N. J. Mr. Anderson, who was 46 years old,

served his apprenticeship in locomotive design and construction with the American Locomotive Company in 1918, following which he worked successively as assistant chief draftsman for the Franklin Railway Supply Company and estimating engineer of the Balmar Corporation. In 1944 he joined Garlock Packing, at Philadelphia, Pa., as railroad representative for the southeastern territory. In September, 1946, he was appointed sales representative for the company's national cooperative accounts, with headquartsrs in New York.

◆

Paul T. Payne, district manager of the Dearborn Chemical Company, at Indianapolis, Ind., whose death was reported in the June issue, entered the company's service 49 years ago as a laboratory technician. Later he entered the sales department at Chicago, and served in various capacities until he was appointed manager of the Philadelphia (Pa.) office. For the past 36 years he was district manager at Indianapolis, covering the southern and eastern parts of the United States.



Paul T. Payne

Personal Mention

General

W. H. Sagstetter, chief mechanical officer of the Denver & Rio Grande Western at Denver, Colo., has retired.

Arthur E. Rice, assistant chief mechanical officer of the Denver & Rio Grande Western at Denver, Colo., has been appointed chief mechanical officer, with headquarters at Denver.

E. A. Sweeley, mechanical superintendent of the Fruit Growers Express, the Burlington Refrigerator Express, and the Western Fruit Express, has been appointed general mechanical superintendent of the three companies, with headquarters as before at Alexandria, Va.

W. H. Clegg, whose retirement as general superintendent of motive power and car equipment of the Grand Trunk Western (part of the Canadian National System), with headquarters at Battle Creek,

Mich., was reported in the May issue, was born at Ledston, Yorkshire, England. He entered the service of the C. N. in 1911 as foreman, air-brake department, at Winnipeg, Man., and subsequently served as instructor; general inspector, air-brake deparment, at Toronto, Ont., and supervisor at Toronto. In 1923 Mr. Clegg was appointed chief inspector, air brakes and car-heating equipment, at Montreal, Que., and in 1939, general superintendent of motive power and car equipment.

JOHN PFEIFFER, superintendent of motive power of the Fort Worth & Denver City and the Wichita Valley (parts of the Burlington system) at Childress, Tex., has retired.

W. H. McAMIS, chief mechanical inspector of the Chicago & North Western, at Chicago, has been appointed acting superintendent of motive power, with headquarters at Chicago.

R. W. SENIFF, engineer of test of the Alton, is now engineer of tests of the Gulf Mobile & Ohio at Bloomington, Ill.

C. W. ESCH, master mechanic of the Alton, at Bloomington, Ill., has become superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Bloomington.

H. B. OSTEN, assistant master mechanic of the Alton, has become shop superintendent of the Bloomington, Ill., shops of the Gulf, Mobile & Ohio, with jurisdiction over locomotive and car shops, including power plant.

KENNETH MOODY has been appointed assistant to the newly created position of general superintendent of motive power and machinery of the Union Pacific, with headquarters at Omaha, Neb.

C. M. HOUSE, superintendent of motive power and equipment of the Alton, at Chicago, has become general superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Mobile, Ala.

H. G. CRONNOBLE, enginehouse foreman of the Chicago & North Western at Ashland, Wis., has been appointed acting chief mechanical inspector, with headquarters at Chicago.

T. C. SALMON, chief clerk to the superintendent of motive power and equipment of the Alton, at Chicago, has become assistant to the general superintendent of motive power and car equipment of the Gulf, Mobile & Ohio, with headquarters at Mobile, Ala.

H. M. NELSON has been appointed mechanical superintendent of the Fruit Growers Express, the Burlington Refrigerator Express, and the Western Fruit Express, with headquarters at Alexandria, Va.

E. J. CRAWFORD, superintendent of motive power of the Chicago & North Western at Chicago, has been granted a leave of absence.

E. A. JOHNSON, mechanical assistant of the Alton, at St. Louis, Mo., has become master mechanic of the Gulf, Mobile & Ohio, with headquarters at St. Louis. The jurisdiction of master mechanic includes

both locomotives and car departments. The position of mechanical assistant at St. Louis has been abolished.

J. L. ROACH, master mechanic of the Fort Worth & Denver City and the Wichita Valley (parts of the Burlington system), at Childress, Tex., has been appointed superintendent of motive power, with headquarters at Childress.

Diesel

F. P. NEESLEY, chief electric and Diesel supervisor of the Michigan Central at Detroit, Mich., has been appointed superintendent of the Diesel shop at Niles, Mich.

L. R. RAETHER, superintendent of the Diesel shop of the Michigan Central at Niles, Mich., has been appointed superintendent of shop at Collinwood Diesel electric shop, New York Central system, at Collinwood, Ohio.

F. R. WAGGONER has been appointed Diesel locomotive inspector of the New York Central System, with headquarters at New York.

W. L. FARNSWORTH has been appointed Diesel instructor of the New York Central System, with headquarters at New York.

C. F. HEILMAN has been appointed Diesel locomotive inspector of the New York Central System, with headquarters at New York.

C. W. WILLIAMS, general foreman, motive power department (Diesel shop), of the Delaware, Lackawanna & Western at Scranton, Pa., has been appointed supervisor Diesel locomotives.

J. A. WETZEL has been appointed Diesel locomotive inspector of the New York Central System, with headquarters at New York.

ERVIN C. MASTER, foreman Diesel shop of the Delaware, Lackawanna & Western at Scranton, Pa., has been appointed general foreman, motive power department (Diesel shop), at Scranton.

G. M. BEISCHER has been appointed Diesel locomotive inspector of the New York Central System, with headquarters at New York.

Electrical

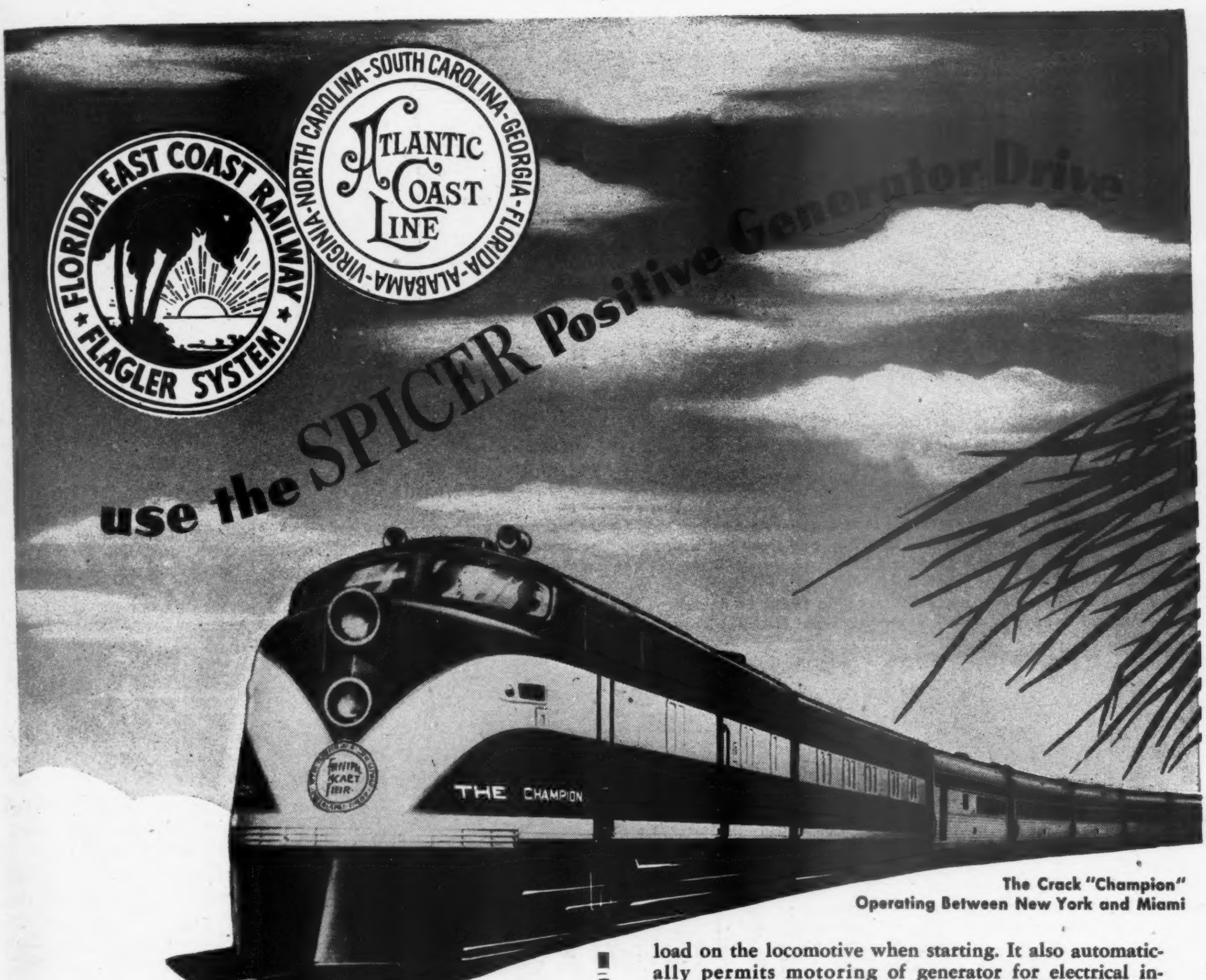
C. A. ALLAN, assistant foreman at the Point St. Charles electric locomotive shop of the Canadian National, has been appointed locomotive foreman, with jurisdiction over the electric locomotive shop at Point St. Charles, Montreal, Que.

Master Mechanics and Road Foremen

A. BETTON, locomotive foreman of the Canadian Pacific, at Brandon, Man., has been appointed division master mechanic at Lethbridge, Alta.

H. R. KINNEY, general foreman of locomotive shops of the Alton, at Bloomington, Ill., has been appointed master mechanic of the Gulf, Mobile & Ohio, with headquarters at Chicago.

J. PURCELL, general master mechanic of the Delaware, Lackawanna & Western at

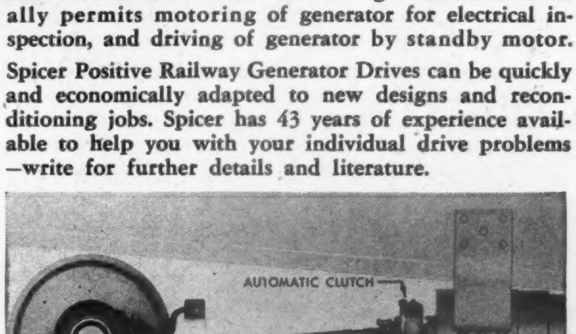


The Crack "Champion"
Operating Between New York and Miami

THE FLORIDA EAST COAST RAILWAY and ATLANTIC COAST LINE are two more of America's railroads relying upon Spicer Positive Generator Drives for steady, dependable power delivery to generators. More than 4000 of these Spicer Drives are in constant daily use on 40 different American railroads, for lighting, air-conditioning and refrigeration equipment.

The Spicer Positive Railway Generator Drive consists of a very simple application of long-lived hypoid gear and pinion mounted on the standard axle. The drive from the gears is positive and constant through Spicer Universal Joints and Propeller Shaft to the Spicer Automatic Clutch mounted between the generator and the propeller shaft. This automatic clutch completely absorbs all shocks and disconnects the drive line in case of excessive overload, and also completely disconnects the generator drive at speeds below 8 miles per hour, eliminating shock loads when cars are being shunted, also preventing any additional load on the locomotive when starting. It also automatically permits motoring of generator for electrical inspection, and driving of generator by standby motor.

Spicer Positive Railway Generator Drives can be quickly and economically adapted to new designs and reconditioning jobs. Spicer has 43 years of experience available to help you with your individual drive problems —write for further details and literature.



Exterior and cross-section view of Spicer Positive Generator Drive

43 YEARS OF Spicer SERVICE

POSITIVE GENERATOR DRIVE

Manufactured, Sold and Serviced by **SPICER MANUFACTURING** *Division of Dana Corporation* • **TOLEDO 1, OHIO**

Scranton, Pa., has been transferred to the position of master mechanic at Hoboken, N. J.

M. A. WALSH has been appointed master mechanic of the Trans-Missouri division of the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Miles City, Mont.

W. L. JONES, master mechanic of the Illinois Central at Jackson, Tenn., has been transferred to Champaign, Ill.

T. E. DUNN, master mechanic of the Delaware, Lackawanna & Western at Scranton, Pa., has been appointed general master mechanic at Scranton.

J. H. BURGER, master mechanic of the Illinois Central at Champaign, Ill., has been transferred to Vicksburg, Miss.

WILLIAM J. HARLOW has been appointed assistant master mechanic of the New Haven division of the New York, New Haven & Hartford.

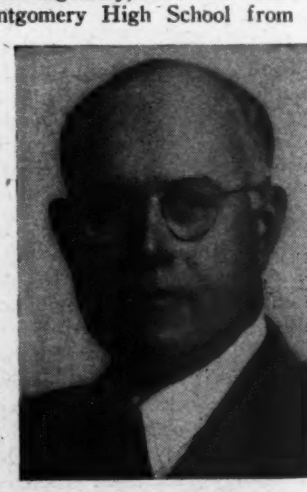
G. F. BACHMAN, supervisor Diesel locomotives of the Delaware, Lackawanna & Western at Scranton, Pa., has been transferred to the position of master mechanic at East Buffalo, N. Y.

M. B. O'MEARA, master mechanic of the Delaware, Lackawanna & Western at East Buffalo, N. Y., has been transferred to the position of master mechanic at Scranton, Pa.

MILES G. STEVENS, master mechanic of the Southern at Birmingham, Ala., has resigned.

C. W. POWLES, master mechanic of the Canadian Pacific at Medicine Hat, Alta., has been transferred to Nelson, B. C.

RAYMOND V. K. JENNINGS, who has been appointed master mechanic of the New York, New Haven & Hartford at Boston, Mass., as announced in the May issue, was born on September 17, 1897, at Montgomery, N. Y. He attended Montgomery High School from September 1904, until March, 1913. He began his career as a machinist helper with the Central New England (since merged with the New Haven) at Maybrook, N. Y., on April 3, 1915. He became an engine inspector on March, 1916; a machinist, in May, 1917; machinery inspector in November, 1919; gang foreman in June, 1920; erecting shop foreman in June, 1921; general enginehouse foreman on December 15, 1923; assistant master mechanic at New Haven, Conn., on April 1, 1940; assistant



R. V. K. Jennings

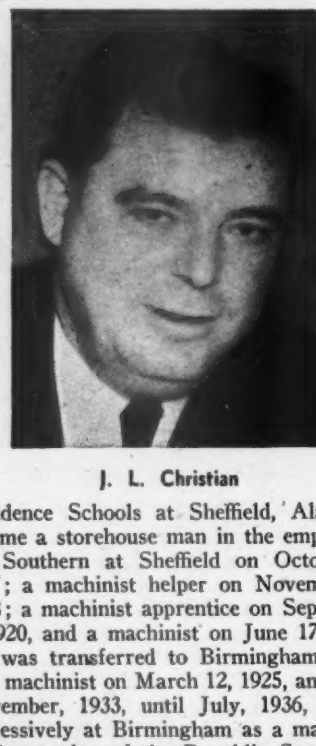
master mechanic at Hartford, Conn., on November 1, 1941; master mechanic at Hartford on January 1, 1942, and master mechanic at Boston on March 1, 1947.

J. C. Smith, general foreman of the Chesapeake & Ohio at Peru, Ind., has been appointed master mechanic, with headquarters at Peru.

Barry Glen, master mechanic of the Trans-Missouri division of the Chicago, Milwaukee, St. Paul & Pacific at Miles City, Mont., has resigned.

D. H. Richmond, master mechanic of the Chesapeake & Ohio at Peru, Ind., has been appointed master mechanic, with headquarters at Huntington, W. Va.

John Leonard Christian, who has been appointed master mechanic of the Southern at Meridian, Mass., as noted in the May issue, was born on March 9, 1903, at Stevenson, Ala. He attended high school at Tuscumbia, Ala., and from 1920 to 1924 studied through the International Correspondence Schools at Sheffield, Ala. He became a storehouse man in the employ of the Southern at Sheffield on October 1, 1917; a machinist helper on November 1, 1918; a machinist apprentice on September 1, 1920, and a machinist on June 17, 1924. He was transferred to Birmingham, Ala., as a machinist on March 12, 1925, and from November, 1933, until July, 1936, served successively at Birmingham as a machinist in the employ of the Republic Steel Corporation and the Sloss-Sheffield Steel & Iron Company. He returned to the Southern as assistant enginehouse foreman on March 20, 1937; was appointed erecting-shop foreman on November 15, 1938; general erecting shop foreman on November 11, 1941; general foreman of the Cincinnati, New Orleans & Texas Pacific at Somerset, Ky., on March 15, 1942; master mechanic of the Kentucky & Indiana Terminal at Louisville, Ky., on April 10, 1944, and master mechanic of the New Orleans & North Eastern at Meridian on April 1, 1947.



J. L. Christian

Robert W. Hooper, who has been appointed division master mechanic of the New York, New Haven & Hartford at Hartford, Conn., as noted in the May issue, was born at Plymouth, England, on December 28, 1901. From 1917 to 1921 he attended British Naval Engineering School and from 1923 to 1925 Northeastern University where he studied railroad transpor-

Seeing Is Believing

When shopping cars or diesel locomotives, Hyatt Roller Bearing Journal Boxes can be easily and quickly removed from the journals and completely dismantled right down to the individual rollers for cleaning and inspection.

To illustrate the simplicity of this operation, and to be of genuine help to railroad operators in setting up their maintenance programs, we have prepared two training films on journal box maintenance which are now being shown to railroad folks all over the country.

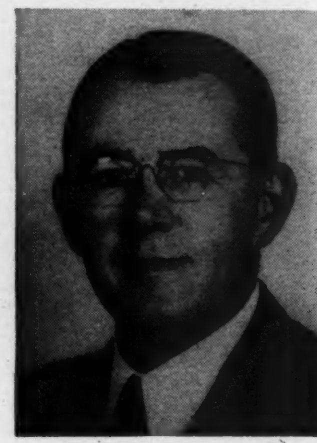
The inherent simplicity of Hyatt Journal Box construction and servicing, for both diesel locomotives and passenger cars, is generally known, but seeing is believing, as these two pictures show.

Write us for further details about how you may obtain prints of these films for your own instruction purposes or to arrange for a showing. There is no obligation.

Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARING RAILROAD JOURNAL BOXES

tation and engineering. Mr. Hooper entered the service of the New Haven on August 6, 1923, as a machinist at New Haven. He became cab signal maintainer in 1924; assistant foreman, mechanical, in 1925; foreman mechanical inspector in 1925; supervisor of cab signals and auxiliary equipment in 1931. From 1942 until 1944 he was a major in the U. S. Army, Railroad Transportation. He returned to the New Haven in the latter year as assistant master mechanic at New Haven and on March 1, 1947, was appointed master mechanic at Hartford.



R. W. Hooper

D. Francis, locomotive foreman of the Canadian Pacific at Winnipeg, Man., has been appointed division master mechanic, with headquarters at Medicine Hat, Alta.

J. W. Martin, master mechanic of the Illinois Central at Vicksburg, Miss., has been transferred to Jackson, Tenn.

W. E. Harmison, superintendent of the car department of the Erie at Cleveland, has retired after 31 years of service.

Anthony Clarke has been promoted to the position of foreman car inspector of the New York, New Haven & Hartford at Oak Point, N. Y

J. B. Harmison, division car foreman of the Erie at Jersey City, N. J., has been appointed shop superintendent at Dunmore, Pa.

F. C. Fraser, car foreman of the Canadian National at Calder, Alta., has been appointed general car foreman of the British Columbia district, with headquarters at Vancouver, B. C.

G. H. Warning, master mechanic of the Canadian National, with headquarters at Regina, Sask., has retired.

G. C. Schiek, assistant general car foreman at the Beech Grove, Ind., shops of the New York Central, has retired.

C. N. Swartwood, shop superintendent of the Erie at Dunmore, Pa., has been appointed supervisor of car repairs, Eastern district, with headquarters at Jersey City, N. J.

John F. McMullen, supervisor of car repairs of the Erie at Cleveland, Ohio, has been appointed superintendent of the car department, with headquarters at Cleve-

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are railroad fuels and lubricants developed by Esso Marketers. Extensive Esso research produces high quality products, often in advance of railroad needs. Esso Railroad Fuels and Lubricants are famous for economy and thorough protection. To railroad men, the Esso oval is the sign of quality, the symbol of service.

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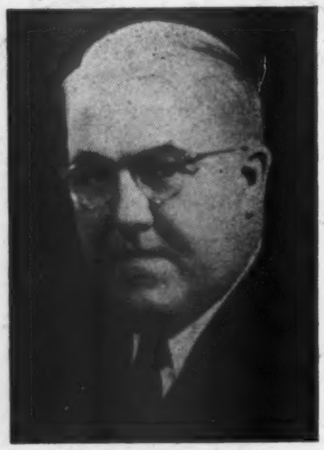
land, O. Mr. McMullen was born in Buffalo, N. Y., and is a graduate of Canisius College, Buffalo, with the degree of bachelor of science. He entered the service of the



John F. McMullen

Erie in 1911 as a material deliverer at the Buffalo, N. Y., car shop. In 1924 he was appointed coach inspector at Buffalo and the same year he was transferred to Niles, Ohio, as car inspector and schedule engineer. He returned to Buffalo two years later as foreman of car repairs and in 1930 became general foreman and division car foreman. In 1937 Mr. McMullen went to Susquehanna, Pa., as shop superintendent and in 1939 to Cleveland as supervisor of car repairs, western end. He was appointed supervisor of car repairs, eastern end, in 1940.

H. A. Harris, master car builder of the Alton, at Chicago, has become master car builder of the Gulf, Mobile & Ohio, with headquarters at Bloomington, Ill.

C. M. Swartwood, shop superintendent of the Erie at Dunmore, Pa., has been appointed superintendent of car repairs, Eastern division, with headquarters at Jersey City, N. J.

Shop and Enginehouse

C. D. Allen, master mechanic of the Chesapeake & Ohio at Huntington, W. Va., has been appointed shop superintendent, with headquarters at Huntington.

James C. Lindsey, Jr., has been appointed general foreman at the North Avenue enginehouse of the Southern at Atlanta, Ga. Mr. Lindsey was previously day enginehouse foreman at Macon, Ga.

John P. Whalen, general machine foreman at the North Little Rock, Ark., shops of the Missouri Pacific, has been appointed general foreman at the North Little Rock shops.

Joseph J. Shea has been appointed general foreman of the New York, New Haven & Hartford at Oak Point, N. Y.

Obituary

Charles R. Sugg, who retired four years ago after serving for 35 years as electrical engineer of the Atlantic Coast Line at Wilmington, N. C., died on June 3 after a long illness, at 72 years of age. In 1926-27 Mr. Sugg was president of the Association of Railway Electrical Engineers.